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EDITORIAL

"SHELTERBELT GOES ON WPA"

THE *Nebraska Farmer* of April 23, 1938 contains an article entitled "Shelterbelt Goes on WPA." This article, viciously attacking the Prairie States Forestry Project, has been reprinted and appears to have been widely distributed. Because of the fact that the article undoubtedly has come to the attention of many foresters, and also because many of the statements made therein are untrue and unwarranted, it is necessary to reply.

The article states that, "In 1936 a Bill was up to give it (the Plains Shelterbelt Project) the backing of Congress, but Congress refused to pass the Bill." This is not accurate as to fact and, in addition, creates an entirely erroneous inference regarding the present authority, given by Congress, for carrying on the work. In 1936 the Budget Bureau approved an item in the Agriculture Department estimates for the Project for the fiscal year 1937 but funds were not appropriated. The following year, however, (May 18, 1937), Congress passed the Cooperative Farm Forestry Act. Late in the fiscal year 1937, immediately after passage of the Cooperative Farm Forestry Act, which authorized farm forestry work, the Budget Bureau approved the inclusion of an item in the third Deficiency Bill to carry on this work for the remainder of the fiscal year 1938. Economic considerations precluded its approval by Congress. Later the Budget Bureau approved in the Agriculture Department estimates an item for the Prairie States Forestry Project for the fiscal year 1939. The Agricultural Appropriation Bill for that fiscal year was pending in Congress at the time the article appeared. The project has always been "on WPA" in the sense that it has operated solely through the use of money derived from Emergency Relief Appropriations.

The article points out that the Forest Service Report for the Fiscal Year 1937 states that while 75 million seedlings were growing in nurseries at the beginning of that fiscal year, only some 29 million were planted or delivered to other agencies, and jumps to the conclusion that one figure or the other must be wrong because there is an apparent discrepancy of some 45 million trees. To anyone acquainted with nursery practice this difference is understandable. Coniferous stock, and some hardwood stock, require more than one year to develop to planting size and hence remain in the nursery past the end of the fiscal year reported upon. Further, the report clearly shows that the 75 million figure quoted was as of June 30, 1936 and thus represented an estimate of recently germinated seedlings made early in the nursery growing season. Not only are there natural and unavoidable losses of plants throughout the growing season, but of

much greater importance is the fact that when the stock is harvested it is rigidly graded to meet certain requirements as to size and other physical characteristics and to discard those plants which do not meet such requirements.

The Forest Service Report does not state that 11,664,567 trees were used *solely* as "replacements." It states that this number of trees was used as "replacements, completions, and improvements." This is quite important since in the 1936 plantations certain rows were left blank in belts because there was not available at that time stock of the proper species to fill them. All of these blank rows were planted in 1937 but since the stock thus used did not replace trees previously planted, its use had nothing to do with the survival of 1936 plantations. Moreover, the survival figure quoted was of June 30, 1936, while naturally replacements are not made in any current year's planting until the end of the first growing season. The memory of man is short, but it must be remembered that the work has been carried on through some of the worst drought years on record, and that survival has been exceptionally good.

The method used to calculate the per acre cost of 1937 plantations was, of course, absurdly inaccurate. The total expenditure for the year was divided by the number of acres in new strips planted during that year. This would be equivalent to a nurseryman's charging his whole investment, as well as operating costs, to each year's output. It failed to take into account classes of expenditures not chargeable to such acres, such as replacement planting due to the exceptional drought year 1936 when survivals were the lowest, residual (undepreciated) value of equipment purchased during the year, expenditure for investigative and similar work, the results of which extend beyond the current year and benefit tree planting work by all agencies in the prairie-plains region.

Naturally expenditures for exploratory and survey work essential to place the program on a sound basis and for required equipment and supplies to initiate a large program were especially heavy in the early years of the project. As an example of decreasing expenditures per acre planted, using this year's operation when some 60,000 acres will be planted, and total expenditures will be approximately $1,742,000, it can be seen that the overall expenditure will be about $30 per acre. As indicated above, a portion even of this year's expenditure on a sound cost basis is not chargeable to this year's plantations.

Whether or not the costs of shelterbelt tree-planting operations are too high is a matter of personal opinion, but certainly an intelligent opinion cannot be based upon a faulty process of reasoning, both as to the cost and the values inherent in the work. Obviously the work should be done with best combination of economy and efficiency.

Despite the unfavorable climatic conditions which have prevailed during the period that the work has been in progress, by June 1 there will be more than 100,000 acres of thrifty plantations on approximately 13,000 farms in six prairie-plains states which are a living testimonial to the fact that trees may be very readily established if the proper methods are used. These thousands of farmers did not *give* up the agricultural use of 100,000 acres of cropland through generous impulse, and probably the best criterion of the success and value of the work is the actual results on the ground and the opinion of the farmers and local people where the plantings have been made.

There is ample room for differences of opinion regarding the shelterbelt project. Such differences of opinion should be based upon a consideration of the facts of the case. Malice and prejudice and blind opposition always are unsafe bases for opinions. Foresters, at least, must base their opinions on facts if they wish to keep their thinking on a professional level.

THE INTEGRATION OF FOREST INDUSTRIES IN THE SOUTHEASTERN UNITED STATES[1]

By W. E. BOND

Southern Forest Experiment Station

Can the present supply of timber in the Southeast support the newly established pulp-mills, in addition to the existing naval-stores industry, the lumber industry, and the many other users of forest products? Will this added drain on the forests result in rapid depletion of the second-growth stands, or will sustained-yield management be adopted? Will each industry in its struggle for existence selfishly gain control of as much timber as possible and wastefully cut its own needs at the expense of other industries, or will integrated utilization solve the problem for all? These and similar question are being considered seriously by foresters, forest owners, industrialists, public officials, and others.

BEFORE discussing the probability of the adoption of integrated utilization in the Southeast, and its possibilities if adopted, we shall consider briefly the timber situation to ascertain if there is a real need for it. If the timber requirements of forest industries already equal or approach the present growth-capacity of the existing forests, then integration is necessary and urgent. Although the Forest Survey, which is the most authoritative source of information, has not finished its work, and estimates of volumes of stands, increment, and drain are not completely available for all survey units, I. F. Eldredge, Regional Survey Director, has been able to present the general timber situation for the South in the following three articles: (1) "A preview of the Forest Survey's findings in the Lower South," published in the 1937 Christmas number of the *Southern Lumberman;* (2) "The forest situation in the Lower South" published in *Paper Trade Journal,* October 28, 1937; and (3) "The supply of second-growth naval stores timber," published in *Gambles' International Naval Stores Yearbook* for 1937-38.

In the first article, it is shown that in the naval-stores region (44.5 million acres of forest land) there were in 1934, 42 billion board feet of pine and 24 billion board feet of hardwood sawtimber, with an additional 50 million cords of pine and 69 million cords of hardwood in smaller trees. There were also 25 million cords of pine and 76 million cords of hardwoods in the upper stems of sawlog-size trees and in the sound portions of cull trees. If pines and hardwoods are combined and these huge figures are reduced to a per-acre basis, namely, 1,490 board feet and 5.0 cords per acre, perhaps they could be more easily grasped.

In the shortleaf-loblolly pine region east of the Mississippi River (36 million acres of forest land) there are 54 billion board feet and 79 million additional cords of pine, including under sawlog-size trees, upper stems of sawlog-size trees, and culls; and 30 billion board feet and 198 million cords of hardwood, or 2,340 board feet and 7.7 cords per acre (pine and hardwood combined). These two forest regions lie chiefly in the Southeast and include practically all of that region.

In comparing the increment and the drain in sawtimber sizes (pine and hardwoods combined) in the naval-stores region, Eldredge shows that in 1934 drain was 120 per cent of the increment. Estimates on this relationship for the shortleaf-loblolly pine east of the Mississippi are not yet available, but in a similar

[1]Delivered at the annual meeting of the Southeastern Section, Auburn, Ala., January 7, 1938.

forest region west of the Mississippi, the drain in sawtimber sizes in 1935-36 was 83 per cent of the increment. Increased production by the lumber industry in 1936 and 1937 and additional drain for pulpwood for new pulpmills have undoubtedly increased the total drain in sawtimber sizes during the past two years.

In the second article, Eldredge makes an estimate, on a 1937 basis, of the total net increment and drain (including probable requirements of the projected new pulp mills) for the naval-stores region and for the shortleaf-loblolly pine region west of the Mississippi. Considering both sawtimber and pulpwood sizes, in the naval stores region he estimates the drain as 141 per cent of the increment and in the shortleaf-loblolly pine region as 84 per cent of the increment.

In the third article, Eldredge and Ineson estimate that there are enough young, round slash and longleaf pine trees to maintain during the next 10 years the naval-stores industry at the present, or a somewhat enlarged, capacity, and to provide the equivalent of 2,200,000 cords of wood from worked-out and round trees not needed for turpentining.

In all three articles, however, it is pointed out that these estimates are only approximations based on various assumptions. It is also stated that totals for a region may not represent conditions for smaller units, and that undoubtedly acute timber shortages already exist at various locations in the Southeast.

I believe we can state without fear of contradiction, therefore, that in the Southeast at the present time the timber situation is acute, with total drain closely approaching total increment and possibly already exceeding it. It follows that integrated utilization and good forest management are urgently necessary if all wood-using industries are to continue at their present or increased capacities. This being the case, what probability is there that the forest industries will generally adopt integrated utilization? And if practiced, will it prove feasible and profitable enough to justify its adoption?

Integrated utilization is not merely a theory. On the contrary, some outstanding examples of integrated utilization are to be found in the South; for example, the Crossett Lumber Company, Crossett, Arkansas. There a thriving city of 5,000 people is practically dependent upon wages received from a group of forest industries, all of which obtain their raw material from the same forest and without any serious competition with each other.

The primary product for which the forest is managed is high-grade sawlogs. All trees are marked for cutting, and no more is cut from an area than will grow back before the next cut, which is planned for 10 years later. Usually, less than the increment is cut, in order to build up the growing stock. No pine trees less than 12 inches d.b.h., or hardwoods less than 14 inches d.b.h. are cut for sawlogs. Also no logs smaller than 8 inches in diameter inside bark and no logs that will not pay their way are taken into the sawmills. The forester and the manager of the mills make periodic inspections of these logs in the woods in order to keep the logging force informed as to the kind of logs wanted and to be sure that poor logs do not go into the mill.

In this establishment, consisting of two large sawmills, dry kilns, planing mills, and a shipping department, several hundred employees produce and ship both pine and hardwood lumber. The poorer grades of pine sawlogs and the tops of pine sawtimber trees are cut into pulpwood. Pine trees below sawtimber size are also marked by the forester and removed in thinning and improvement cuttings in order to improve stands for more and higher-quality growth and to furnish pulpwood to the company's pulpmill. Some pine trees are selected and cut for poles and piling, and some of the young trees in dense stands seriously in need of thinning are cut for fence posts. Promis-

cuous cutting of the best trees for poles and pilings in advance of logging has been discontinued because of the waste involved and because these trees are often more valuable for sawlogs. The posts, poles, and piles are impregnated in the company's wood-treating plant. The tops of hardwood sawtimber trees and those species and individuals which are too poor for sawlogs are cut into chemical-wood and taken to the company's hardwood distillation plant.

The forest, from its first thinning to the final cut of its finest and largest trees, contributes raw materials that are converted into finished forest products and profitably marketed. In this case selective timber-management on a sustained-yield basis and complete and integrated utilization under a single management are thus proving very efficacious and profitable. Crossett is only one of a number of examples of integrated utilization in the shortleaf and loblolly pine region.

In the slash and longleaf pine region other examples of integrated utilization could be cited. I have visited several operations in this region where good forest-management was being practiced, the primary product being high-grade sawtimber, much of which was cut into timbers for export. High-grade pine trees were commonly turpentined a few years before cutting, and yields as high as 75 units per crop were obtained without interfering with the production of the high-grade sawlogs. At the time of my visit, no profitable market for pulpwood existed, but thinnings were utilized as far as possible for the production of fence posts that later were creosoted under pressure. With an added market for pulpwood, integrated utilization would be more nearly complete.

I have also visited operations in Georgia that were being operated primarily for naval stores. Good forest management was restricting naval-stores operations so that stands were being built up which shortly would support many more cups per acre. Worked-out turpentined trees suitable for poles and piling were being so utilized. Lumber was also being cut from the larger worked-out trees of suitable quality and from loblolly pines and hardwoods cut from swamps and bottomlands. Trees suitable for pulpwood only were not salable at the time of my visit, but with the present available market for such inferior material, thinnings and improvement cuttings are feasible and return a net income with which to meet taxes and other carrying charges on young timber until profitable naval-stores operations are possible.

A question may be asked as to whether it is necessary or desirable to develop corporations such as the Crossett Company, which groups the several integrated forest industries under one ownership. I can see no necessity for this procedure, although such a set-up seems very efficient.

But why cannot the forest owner practice integrated utilization without owning all or even any of the manufacturing plants? For example, he could sell his high-grade sawtimber to the sawmill offering the highest price; perhaps handle the naval stores himself; and sell his pulpwood to the pulpmill from the tops, from the low-grade, worked-out trees, and from thinning and improvement cuttings.

Why should not even the pulp company sell high-grade logs, poles, and piling, and utilize only the lower-grade material for pulpwood? Although it might cut pulpwood from good sawtimber trees and realize as much profit as the sawmill, it could sell this stumpage for a good price and with this money purchase from other owners three or four times as many cubic feet of pulpwood cut from poorer material. With sawtimber stumpage valued at $6 per M feet and pulpwood stumpage at $1 per cord, the sawtimber has a value per cubic foot about three times that of pulpwood. Furthermore, since the pulp company cannot afford to lose the possible income from turpentin-

ing trees before cutting for pulpwood, there is no reason why it should not lease out the turpentining rights.

So far it has been pointed out that several operating companies seem to be managing and utilizing profitably their timber, but no definite figures or information that might help a company or an individual to practice integrated utilization profitably have been given. The pulp companies that have recently purchased large bodies of timber must decide whether they will grow pulpwood material alone, whether they will combine naval stores with pulpwood, or whether they will combine lumbering, naval stores, and pulpwood production.

The naval-stores operator faces similar problems. Should he grow some high-grade sawtimber along with the trees he is working? Should he grow trees to 11 inches d.b.h. or larger before turpentining, so as to cut logs from worked-out trees? Or is the 9-inch limit, with worked-out trees cut chiefly into pulpwood, more profitable?

These important economic problems concerned with yields, incomes, costs, and profits foresters have been asked to solve, but we do not yet have sufficient reliable data on which to base sound recommendations for all cases. I am sorry to say that with very limited funds for economic research the Southern Forest Experiment Station has been able to study very few of these economic problems in the Southeast. With our available funds we have found it necessary and efficient to concentrate our economic studies on our Crossett Experimental Forest in the shortleaf-loblolly pine type. While the specific returns, costs, and other results obtained from these studies at Crossett may not apply directly to longleaf and slash pine, I believe that the principles that have been determined do apply. Probably the results, and certainly the principles, should apply to the shortleaf and loblolly pine forests of the Southeast. I think I am justified, therefore, in including in this paper some of the pertinent results obtained from our studies at Crossett that bear on integrated utilization.

The Crossett Experimental Forest is composed of typical second-growth sawtimber stands which are being managed for profitable sustained yield under commercially feasible practices. One of the first requirements of good management is to build up the stand, which in all parts of the South is generally understocked and composed of many poor species and individuals. Our first task on our experimental forest was, therefore, to improve the stands by cutting. In so doing, we removed those trees which were defective, limby, or in some other way unsuitable for present or future sawlogs, and cut them into pulpwood.

We found that in thus improving the stands we should remove about 1 1/3 cords of pulpwood and 2 cords of chemical hardwood per acre. A careful record was kept of all costs and returns. After deducting all costs of marking and producing from the selling price, a margin of approximately $0.80 per cord remained for stumpage, profit, and interest for pine pulpwood and of about $0.25 per cord for the chemicalwood. We also cut pulpwood in thinning dense, young stands of old-field pine; and we had a margin between costs and selling price of $1.20 per cord. The costs of cutting pulpwood from trees 10 inches d.b.h. was about half that of cutting pulpwood from 5-inch trees. In cutting sawtimber in typical second-growth stands we found that about one-fourth the merchantable cubic volume of sawtimber trees could be cut more profitably for pulpwood than for sawlogs. This topwood was readily accepted by the pulp companies, and the cutting costs were no higher than for cutting whole trees.

Where markets are available, therefore, the cutting of pulpwood as a part of integrated utilization appears feasible and profitable in the shortleaf-loblolly pine region. Studies of pulpwood production

in longleaf pine stands have shown even greater margins for stumpage and profit. Without a market for pulpwood, however, thinning and improvement cuttings are usually not economically feasible.

In uneven-aged stands of shortleaf and loblolly pine containing both clear-stemmed, thrifty trees and defective, limby or crooked trees, and in mixed pine-hardwood stands, a selection system of management, with frequent but light cuts, appears desirable. We have not yet determined accurately what length of cutting cycle will prove most profitable, but growth rates, logging costs, and general observations lead us to believe that between five and ten years is the desirable length. We have set aside 24 forties on the Crossett Experimental Forest on which we have made a 100 per cent cruise of volumes and log grades and on which we are testing costs and returns, using 8 forties each with 3-, 6-, and 9-year cutting cycles. Short cutting cycles mean light cuts, but our studies of truck logging in which about 700 to 4,000 board feet per acre were removed from 7 separate areas, showed very little difference in costs; and we are convinced that a cut of as little as 500 board feet per acre is feasible.

A mill-scale study which we conducted showed that the value of lumber produced from large trees had a much greater value per thousand board feet than that from small trees. The logging costs for large trees were also less per thousand board feet than those for small trees. Based on a unit of 1,000 board feet, the margin between total production costs and total lumber-sales value was $1.43 for 12-inch trees, $4.73 for 16-inch trees, $8 for 20-inch trees, and $11.42 for 24-inch trees. Much to our surprise, second-growth shortleaf and loblolly pine produced almost as high grades of lumber as virgin timber, running about 20 per cent of B & B.

The importance of growing trees to larger diameters and of producing clean, high-quality logs was forcefully brought out in our study. Light cuts in all merchantable sizes at short intervals will gradually build up the volume and quality of the growing stock, and provide for a very desirable shift in the major portion of the future growth and yield from the smaller and inferior trees to the larger and better one. I believe that this method will work equally well in slash pine, but in longleaf the problem of reproduction may make it less practicable. The selection system fits in very well with integrated utilization, making it possible to select and to cut trees for specific uses and thus usually to secure the best prices for stumpage.

Naval-stores operations complicate forest management, and to learn precisely where they fit into integrated utilization is a problem. There is no question but that naval stores will be the primary product in most operations of the Southeast for many years to come. Although we do not yet have substantiating figures from definite economic studies to prove it, I believe that profits can be increased if the size of the minimum tree to be turpentined is increased from 9 inches d.b.h. to at least 11 inches. While it may not be feasible economically for most owners to leave trees, that under present practices are turpentined when 7 or 8 inches d.b.h., unturpentined until they become at least 11 inches d.b.h., it may be feasible, and perhaps ultimately more profitable, to increase gradually the minimum size of trees to be turpentined until a minimum of 11 or 12 inches d.b.h. is established. If each face is turpentined for 5 years and if a rest period between working front and back faces is omitted, a tree 9 inches d.b.h. can support on its circumference only one front and one back face, whereas an 11-inch tree would permit working three faces 5 years each.

Studies made by the Southern Station show that slash pines 9 inches d.b.h. on fair sites yield 48 units per crop while 11-inch trees yield 63 units per crop, or 31

per cent more. The 11-inch trees (which, according to estimates will grow to 14 inches d.b.h. during 15 years of turpentining) will yield, when cut as worked-out trees, sawlogs, or possibly poles, from the lower stems and pulpwood from the upper stems; while the 9-inch trees, which will grow to only 11 inches d.b.h. during 10 years of working, when worked out will be suitable only for pulpwood—a product of much lower stumpage value than sawtimber. Thus by increasing the minimum diameter, lumber could be added as another product and another source of income. I believe furthermore that it would be profitable to reserve the very finest and most thrifty trees for development into high-grade sawtimber or piling and to turpentine them only 3 or 4 years before cutting. Improvement cutting, and perhaps thinning, at 5- or 10-year intervals, reserving each time the best turpentine trees and removing those that interfere with the reserved trees, should yield a profitable cut of pulpwood and at the same time keep the forest in the best growing condition. Undoubtedly integrated utilization in naval-stores forests would be more profitable than turpentining alone.

At the end of this paper we still are unable to answer all the questions set up in the first paragraph, but the following conclusions may be drawn:

(1) There seems to be little doubt but that drain equals or exceeds increment, and that integrated utilization and sustained-yield forest management are therefore necessary if existing forest industries are to be sustained at their present capacities.

(2) The new market for pulpwood is a real incentive to practice desirable forest management to those owners following a long-time management policy, although it may tempt those owners wishing to cash in on their growing-stock to liquidate young timber.

(3) Integrated utilization and also sustained-yield management are feasible and profitable, under certain conditions, as shown both by experimental studies and by actual examples of large-scale operations.

Only time will tell whether industry and forest owners will adopt these measures generally. With huge investments in plants that must be depreciated over many years, and with greater profits to be made both by forest owners and by manufacturers who intelligently practice integration, it seems reasonable to expect that integrated utilization and sustained-yield forest management will be adopted rapidly. Such action is both necessary and desirable if the thriving forest industry in the Southeast is to be made permanent.

DEVELOPMENTS IN THE PULPWOOD SITUATION IN THE SOUTH[1]

By N. D. CANTERBURY
South Carolina Commission of Forestry

One of the outstanding events of 1937 was the marked increase in the development of the pulp and paper industry in the southeastern region of the United States. All the states from Virginia to Texas are included in this industrial growth. The number of establishments in operation and under construction is close to fifty. The social and economic implications of this step in the industrialization of the South are very far reaching and are not dealt with in this paper. The author deals only with some of those phases of the movement that more directly concern foresters.

PULP mills have been attracted to the South by three main factors: First, an abundant supply of cheap wood; second, a plentiful supply of cheap labor; and third, by tax exemptions and other financial considerations.

Their coming has been heralded in some quarters as the greatest boon that could be granted to us as foresters, in that, by providing a market for small-sized material, it facilitated real forest management.

I believe we can all agree that the establishment of a market for pulpwood is a constructive event. There are, however, few developments of significance in the field of marketing that are not attended by abuses. This fact was recognized by the pulpwood industry last May when a meeting was called at New Orleans for the purpose of drawing up a conservation policy for the southern pine pulpwood industry. That meeting was conceived and initiated by the southern group of the Pulpwood Association membership. To it were invited representatives of the U. S. Forest Service, and of the state forest services, with the request that they serve in an advisory capacity. At the meeting there was presented for discussion a seven-point statement of policy which had been drawn up by the representatives of the pulp mills present. The statement was adopted with minor changes.

The real meat of the policy statement is to be found in Articles 1, 2, 5, and 7.

Article One states, "It is agreed that all land, including non-company land, must be cut over in a manner which will maintain and build up the forest growing stock."

Article Two reads, "It is agreed that each pulp mill operator will employ the necessary qualified personnel to insure proper compliance with agreement Article 1."

Article Five asserts that the subscribers "Agree to satisfy to the fullest practicable extent, the requirements of each mill from improvement cuttings, worked out turpentined timber and salvage from sawtimber cuttings."

Article Seven sets forth that "The Industry agrees to secure insofar as possible the full compliance of its wood producers with the procedure of forest practices as established for each group."

It may be stated in passing that Articles 3 and 4 provided for the establishment of working groups for the purpose of preparing rules of forest practice to carry out Article 1, while Article 6 called attention to the importance of an extension of forest fire control measures.

The significance of the voluntary adoption of this platform by industry can hardly be overemphasized. With the recognition of growing stock in Article 1, and that it must be maintained and built

[1]Presented at the annual meeting of the Appalachian Section, Spartanburg, S. C., January 14, 1938.

up; the further recognition in Article 2, of the need for employing technically trained foresters—for who but a forester can say whether growing stock is being maintained and built up?—the acknowledgment in Article 5 that pulpwood may well be regarded as a secondary product in an integrated program of wood production; finally, in Article 7 that the responsibility for compliance with the rules rests with industry; what more could be asked?

It remained to be seen how the various working groups would act in drawing up rules of forest practice to put these policies into effect.

The first group meeting was at Mobile. It was attended by twelve representatives of industry, three from state forestry departments, and one from the U. S. Forest Service. At the outset it was apparent that industry had no prepared plan, and that it would proceed with extreme caution. One member read a statement couched in very general terms, so broad in its purport that it could not conceivably be regarded as carrying out the purposes of the New Orleans policy statement. The U. S. Forest Service representative then presented a carefully prepared five-page statement of pulpwood cutting rules which had been prepared jointly by Forest Service men from the regional office at Atlanta working with foresters from the Southern and Appalachian Forest Experiment Stations.

Unfortunately so little time had elapsed between the New Orleans and Mobile meetings that there had been no opportunity to get the Forest Service set of rules into the hands of industry's representatives for review and discussion prior to the Mobile meeting. Industry tended to back away from a set of rules which, at first glance, seemed unnecessarily long and complicated, for, in fact, they covered not only the Mobile working group, but the entire Southern Region.

After several hours of discussion there were tentatively adopted several rules having to do with the leaving of seed trees, the thinning of young stands, and others recognizing the need for cooperative action in fire control and other matters. The outcome of this meeting was a distinct disappointment to those of the forestry profession who had been following the movement, and with reason, for other group meetings tended to follow the lead of the Mobile group.

At Savannah a set of rules was adopted that was a considerable improvement over those drawn up at Mobile. But these also failed to make effective the New Orleans policy. It began to be apparent that the progress of the industry along the path of self-regulation with regard to cutting practices would, of necessity, be more gradual than at first had been envisioned.

There followed other group meetings with results differing not essentially from those at Mobile and Savannah. Summed up, the industry agreed to leave seed trees unless reproduction was already established, and to refrain from cutting below a stated minimum size of tree except for thinning. Each group agreed that the rules adopted were to be tried out for several months, and, later, to be reviewed and revised at subsequent group meetings.

Several months followed during which there were wholehearted attempts on the part of the more progressive companies to put the forest practice rules into effect. The rules were issued in printed form to contractors and producers, and in some cases the rules were embodied in the agreements with the contractors. Several companies held meetings of their contractors at which the prescribed methods of cutting were explained. Other companies paid no attention to the rules at all, nor did they call them to the attention of their contractors.

Be it said in all fairness to the operators that they encountered numerous obstacles in trying to advance their program. Many of them were taking wood on contracts written prior to the inauguration of

the conservation program. Few, if any, were operating on owned land. Contractors met with frequent requests that all trees be cut in order that land be cleared for agriculture, or that the landowner might receive the maximum revenue obtainable.

Inspections by state and federal foresters revealed all degrees of compliance. Some companies were leaving more trees standing than their rules called for, while others were leaving none at all. One operator stated that the rules were all very well when other problems were not pressing, that they would be given consideration when a balance had been attained between wood supply and wood demand at his mill. Balanced against such disheartening statements were the really encouraging results being obtained by the more conservation minded operators.

In November, 1937 there came an announcement by the Pulpwood Association that there would be a meeting in Jacksonville, Florida, the second week in December for a review of the pulpwood situation, and for revision and harmonizing of the forest practice rules of the various groups. As before, the U. S. Forest Service and the state forestry organizations were invited to attend in an advisory capacity.

On this occasion the foresters held a preliminary meeting at which there was a general discussion of pulpwood cutting practices. The consensus was that while the rules as adopted by the industry are in the opinion of the foresters inadequate to build up forest growing stock, they are, nevertheless, a very constructive step in the right direction, and that the industry should concentrate on the enforcement of the rules as adopted rather than attempt revision at this time. There was no withdrawal on the part of the foresters from their advocacy of the pulpwood cutting rules as drawn up by the Forest Service.

At the several sessions which followed representatives of industry took action to bring into harmony the sets of rules adopted by the four working groups into which the region had been divided. Of particular significance at the general session was the appointment by industry of a committee to be known as "The Committee on Information, Inspection and Publicity." The purpose of this committee is "to investigate and report to the members the best method of creating a central organization to cooperate with the public agencies in furthering the conservation program, and to look after the publicity which is essential to proper public understanding of industry's aims."

As a result of these meetings and the discussions attendant upon them, we find attention focused on several practices which have been much criticized. Most outstanding among these is the contractor system of wood procurement in vogue at most of the mills. Under this system the wood producing territory tributary to a mill is divided into districts, each of which is assigned to a contractor. The mill will buy wood from that district only through its contractor, who is paid an agreed sum per unit or per cord for all wood f.o.b. shipping point.

Few contractors actually get out wood. As a rule, they operate entirely through subcontractors. A landowner may cut his own woodlot and do his own handling and loading as well. Elsewhere, the entire operation is done by the subcontractor who is usually financed wholly or partially by the contractor. Since most of the mills now operating seem to prefer to obtain their wood supply from non-company lands, the contractor system more nearly solves the problem of continuous current wood supply than any other means yet devised. Working on a commission basis, the contractor has every incentive to ship as much wood as possible, and to take all the wood available from any woodlot purchased. Not infrequently the landowner insists that all the salable trees to be taken.

No satisfactory substitute for the con-

tractor system of wood procurement has yet been evolved. Alternatives being considered include (1) direct long-time contracts between the mill and the owners of large acreage, (2) establishment of wood buying agencies at various points; these agencies to buy wood only from the owner of the land from which that wood comes, (3) placing of contractors on a salary basis. None of these alternatives is particularly attractive under present conditions.

A second source of revenue to the contractor—in addition to his buyers commission—is found in the "lump sum" method of timber purchase most commonly employed. This system also has occasioned much criticism. Few rural landowners are sufficiently informed to enable them to protect their interests in a timber sale. They know little of timber volumes or values. And yet there are frequent reports that landowners themselves have insisted on this method of dealing. In such cases the feeling seems to be prevalent that a certainty, in the form of a lump sum, is preferable to a sale on a unit basis with the responsibility on the landowner for checking the quantity cut. A most constructive proposal has been made by one mill looking toward the solution of this problem. It is suggested that a lump sum be offered on a unit basis. If the quantity cut exceeds the estimate on which the lump sum offer was based, the overage will be paid for at the same unit rate.

A third controversial subject is the unit of measure used in pulpwood purchases. A confusion has arisen because some of the mills have consistently used the term "cord," which is generally understood to mean a stack of four-foot bolts eight feet in length by four feet in height, when referring to a "unit," or a similar stack of bolts greater than four feet in length.

There has also been criticism of the procedure of having wood stacked in pens, as practiced by many subcontractors. In my opinion, no stigma attaches to this practice so long as it is clear to the laborer that he is being paid by the pen, rather than by the cord or unit. It hardly need be pointed out here that the number of pens per cord varies considerably with the diameter of the bolts. Subcontractors in some localities avoid use of the above mentioned units of measure in dealing with labor by paying for cutting by the bolt. At least one mill buys its wood on the basis of green weight.

There can be no legitimate objection to the purchase by industry of its raw material in any unit desired so long as there is no misunderstanding on the part of the landowner as to the details of the transaction. Mention is made of these points not as a general criticism of industry, but to bring out the fact that industry is much better able to protect itself in transactions of the type under discussion than is the landowner. Industry profits by the experience gained through many transactions of the same general nature, while the individual landowner makes few timber sales.

Any approach to a real solution of the problem of establishing the pulpwood business on a permanent basis should be through the landowner. Theoretically, at least, the landowner should be interested in growing and marketing those forest products which, in combination, will return the greatest revenue. He should be interested in integrated utilization. In such a picture pulpwood should probably be classed as a secondary product, and should only be taken out as a salvage crop or when its removal will improve growing conditions of the remaining stand.

The industrialist, on the other hand, is faced with the problem of obtaining large quantities of a single product. That he may incidentally acquire timber of a quality which is suited to other uses may not be of any concern to him if his mill needs wood.

Concern has been manifested by other wood-using industries—lumber, poles and

piling, veneer, cooperage, naval stores—lest the bulk of the young timber be taken by the pulp users before it attains sufficient size for purchase by them. It must be remembered that the industries just mentioned have, for the most part, operated in a buyers market for decades with little endeavor on their part to perpetuate the resource. Now that a market offers for small sized material, they are faced with the necessity of acquiring stumpage of pulp size and carrying it to maturity rather than let "John Landowner" carry that load.

New markets and increased competition for stumpage will help, rather than hinder the landowner who is interested in forest management.

It should be recognized that the pulpwood operators in the South are doing pioneer work in the field of self-regulation along conservation lines. To some operators, any form of regulation is anathema; and it may be expected that the more progressive members may have difficulty in keeping the independents in line. Certainly, industry should be given ample time to show what it can and will accomplish in the field of self-regulation.

Undoubtedly there will be attempts on the part of governmental agencies to enforce conservation measures by means of severance or processing taxes. Whether or not such attempts will bring about a more desirable conclusion than that obtainable through industry's own efforts is questionable.

In closing, I want to quote in part from the final paragraph of a paper presented by H. A. Smith at the Jacksonville meeting:

"I feel very strongly . . . that the industry can solve its own problems. I have given up hope of an individual mill getting results. Your salvation lies along the same line upon which you first started—industrial action based upon your conservation code at New Orleans, operating under real cutting practice rules, under the technical guidance of an industry conservation division bearing the confidence of each mill, of the public forest agencies, and last, but not least, of the public itself."

Termite Exhibit

AMONG the features in the newly-opened west wing of the Museum of Science and Industry in Chicago is an exhibit on termites, prepared under the direction of Miss Olive Falls, entomologist for the American Lumber and Treating Company. Termites are generally considered as an insect which shuns light. This belief, however, has been disproven by Miss Falls who has arranged the displays in such a manner that a large number of colonies of live termites may be observed and studied in their attacks on various commercial woods.

An attempt is made to bring out the economic phases surrounding the termite by showing what it looks like, what it does, and how, through proper construction, it may be controlled.

All foresters who may be passing through Chicago are invited to spend a few hours at the Museum and see this exhibit which is but one of a number of scientific and technological displays.—Helmuth Bay, *Museum of Science and Industry.*

THE FARMER'S SIDE OF THE PULPWOOD PROBLEM IN THE SOUTH[1]

By G. H. LENTZ
U. S. Forest Service

The rapid expansion of the pulp and paper industry in the South has created a market for small-sized pine timber. Pulpwood requirements cannot be met entirely from company-owned or controlled lands. A large portion of the supply will have to come from privately owned forests, particularly farm woodlands. The author discusses the pulpwood problem in the South, as it affects the farm woodland owner, and the necessary steps to see that these farm woodlands are kept productive.

THE current expansion of the pulp and paper industry in the South Atlantic and Gulf Coastal states has been brought about primarily through the construction of mills to manufacture kraft or sulphate pulp and paper using second-growth yellow pine as raw material. During the past year (1937) seven new mills started production in the 11 southern states included in Region 8 of the U. S. Forest Service. Construction work was actively under way on six additional mills, two of which will probably manufacture sulphite pulp and alpha cellulose for conversion into rayon. The expansion has temporarily ceased owing to market conditions, but it has been reported that several companies are contemplating the erection of additional mills in the near future. By the end of 1938 there will probably be 37 mills and possibly more operating in the Southern Region, of which 30 will use pine as their chief source of pulpwood. The other mills in North Carolina and Tennessee are operating mainly on chestnut, and one mill in Mississippi uses cottonwood and willow primarily.

This article will deal only with the southern pulpwood situation with respect to pine pulpwood and how it affects the farm woodland owner.

The introduction of the new mills may be either a blessing or a menace to the South and to southern farmers, depending on the cutting practices and forest management policies which the various companies adopt. Certain areas such as southeastern Georgia, and northeastern Florida, southern Alabama, and northern Louisiana are already overstocked with mills, and a highly competitive market exists for both pulpwood and timberlands. Pulpwood purchases and shipments are being made in areas up to 200 miles from the receiving mill with some of the shipments passing three or four mills before reaching their destination. The other forest industries in the region have become alarmed over the competition for timber, particularly on account of the fact that the pulpwood operators can use trees as small as 6 or 7 inches d.b.h., before they even reach turpentine size or before they are suitable for other products.

When the 30 mills referred to above are in full operation they will require about 4,000,000 cords of pulpwood annually, or 12,360 cords per day. It is estimated that the 30 pine mills own or have cutting rights on approximately 4,700,000 acres of timberland. The stands average less than 5 cords per acre. If we assume an annual growth of 1/3 cord per acre per year, the company-owned lands could produce 1,566,000 cords each year, leaving 2,390,000 cords to be obtained from other sources until the company lands can be built up to better production. So it is safe to say that more than a million

[1]Presented at the annual meeting of the Southeastern Section, Auburn, Ala., January 7, 1938.

cords of the total will be supplied annually from farm woodlands.

Of the 191,777,000 acres of timberland in the 11 southern states in Region 8, it is estimated that about 130,431,000 acres can be classified as pine or as pine-hardwood with pine predominating. Of this amount approximately 59,000,000 acres may be classed as farm woodlands where pine predominates. This acreage is contrasted with the 4,700,000 acres of timberland estimated to be owned or controlled by the pulp and paper industry in Region 8 as of January 1, 1938. The company owned lands are being added to through purchase, and the increased demand for well stocked lands has resulted in an appreciable increase in forest land values.

The general policy of the pulp and paper companies now operating has been to reserve their own timber as far as possible, to increase their timberland holdings, and to buy pulpwood in the open market from timberland owners and farm woodland owners. Because of an abundant supply of second-growth timber below sawlog size throughout most of the region, the operators in the past have had a buyers' market and much "distressed" wood has been purchased and cut for pulpwood. In order to build up their local reserves and to extend their buying territory, many of the mills are having their contractors ship pulpwood from areas 175 to 200 miles distant with freight charges as high as $2 per cord. There has been, however, only a slight increase in the price paid for pine pulpwood stumpage and lump sum purchases have been all too frequent. The increases in price paid per cord at the mill have been largely absorbed by the contractors and by higher shipping costs.

The 59,000,000 acres estimated to be in farm ownership in the 11 states where pine timber predominates are and will continued to be an important source of pulpwood. The timber stands on these farm woodlands, as a result of overcutting, grazing, fire, and mismanagement, are probably growing at less than the regional average of 1/3 cord per acre per year. With some effort, however, the growth might easily be increased to ½ or ¾ cord annually. In exceptional cases on good sites and with well stocked stands, even a cord per acre per year may be grown.

There is need for an incentive to induce the farm landowner to take care of his woodlands, to build up his growing stock, to increase the rate of growth, and to decrease the loss from fire. He cannot be expected to do this, however, and to continue to grow pulpwood if his returns from the sale of pulpwood stumpage are only 25 to 50 cents per cord. Various authorities have shown that it costs about 75 cents per cord to grow pulpwood in the South. Unless the landowner is able to show a profit on his forest area he cannot be expected to continue in the wood growing business. Under a management plan providing for a program of integrated use, pulpwood can be obtained from intermediate cuttings in the nature of thinnings and improvement cuttings. With the present understocked condition of much of our farm woodland area, cutting should be kept at a minimum in order to build up the growing stock. If heavy cuttings are made for pulpwood this building up will not be possible, and further depletion with consequent reduction of the growth per acre will take place.

Factors Favorable for Pulpwood Production by Farmers.—There are certain factors in favor of pulpwood production on the farm woodlands. They can be listed as follows:

1. The farm woodland owner can often cut and market small amounts of wood.

2. A market is provided for the product of thinnings and improvement cuttings, enabling the owner to reduce his carrying charge on the timber he may want to grow for products of a higher value.

3. Pulpwood can often be cut when farm labor cannot be otherwise gainfully employed and thus labor, teams, and equipment can be kept busy.

4. Protection costs of farm woodlands are low.

5. No special equipment for cutting and marketing wood is required.

6. Repeated cuttings on a selection basis can be made so as to assure future crops.

7. Nearly every farm has some land unsuitable for the production of farm crops but still suitable for growing forest crops.

Unfavorable Factors.—Offsetting the favorable aspects of pulpwood production by farmers are other unfavorable factors.

1. Certain mills do not maintain an open market for farm-grown wood.

2. Pulpwood deliveries at the mill have to be made on regular schedules to keep the mill in operation.

3. Low prices are paid for delivered wood and for stumpage.

4. The contractor system, generally used, allows no farmer delivered wood and often absorbs most of the stumpage values.

5. In order to prevent loss through sap stain in summer, wood must be delivered within 10 to 14 days after cutting.

Where the landowner cannot operate his own timber he is at a decided disadvantage because of the low prices paid for pulpwood stumpage. Stumpage is often purchased on a lump sum basis with the purchaser practicing clear cutting in order to get a maximum cash return. Such practices leave the woodland in such shape that it is often impossible to get another cut for 20 years or more. The landowner becomes discouraged, fails to protect his cut-over land, and the production of a future crop of timber is thus further retarded.

Prices Paid for Pulpwood

Each mill has a definite price paid for pulpwood delivered at the mill and a second price for wood delivered at railroad or barge shipping points. Not only do the prices vary from mill to mill, but the wood specifications of the various companies also vary. For example, one mill purchases only 5-foot peeled wood for which it pays $4.75 per 1¼ cord unit at the mill. Another company pays $3 per standard cord for rough wood along the railroad or $3.50 delivered at the mill. A third mill pays $5 per 1¼ cord of rough wood at the mill. The highest price now being paid is $7 per 1¼ cord for peeled yellow poplar and $6.50 for peeled pine loaded on the cars.

No standard unit of measure is used in purchasing pulpwood; the units vary from 128 to 160 cubic feet. In a recent report of the U. S. Tariff Commission the average cost per cord of pulpwood delivered at the southern sulphate mills was shown to be $4.85 in 1934. During the same period the cost per cord was $9.12 in New England and $6.10 on the Pacific Coast. Present costs are only slightly higher.

Production costs vary according to size of the trees and density of the stand, length of haul, and length of rail shipment. The cost of cutting and penning is fairly uniform at 15 to 20 cents per pen, or about 80 cents to $1 per cord.

On one farm woodland the costs of cutting and delivering pulpwood by a contractor were:

	Per standard cord (128 cubic feet)
Cutting	$0.80
Hauling 3 miles	1.40
Freight 20 miles	.75
F.o.b. mill	$2.95

This wood brought $3.50 per cord on the cars at the mill. Thus 55 cents was allowed as stumpage and profit to the contractor.

On a longleaf and slash pine operation with a 12.2-mile truck haul a recent study showed a production cost varying from

$2.03 per 1¼ cord of round wood from trees 13 inches d.b.h. to $2.67 per 1¼ cord where the sticks were cut from trees 5 inches d.b.h. This wood cost the contractor $1 per unit stumpage, and the f.o.b. mill price was $5 per unit, leaving an average of about $1.65 per unit or $1.32 per cord for the contractor's profit. (See Occasional Paper 58, Southern Forest Experiment Station.)

It has been estimated that it costs about 70 to 75 cents per cord to grow pine pulpwood. In many instances the farm woodland owner has received less than 50 cents per cord stumpage where he should have obtained at least $1 to $1.50 per standard cord. Where lump sum purchases have been made by contractors the owner has seldom known the true value of his wood.

Cutting practice rules have been adopted by the four southern groups of the American Pulpwood Association. In general these rules, applying to cutting on privately owned land including farm woodlands, specify that seed trees should be left and that a certain number of trees per acre should be reserved when thinnings are made. These rules are an attempt on the part of the industry to keep forest lands productive.

Compliance with the cutting practice rules have varied company by company. Several of the more progressive operators have considered the rules only as absolute minimum requirements and have adopted cutting practices far in advance of the group rules. In other instances there has been no attempt to get compliance. With some exceptions, the group rules have now been placed in the hands of the pulpwood contractors. A beginning has been made. Foresters are being hired by many of the pulp and paper mills and they are supervising the cuttings on company and non-company owned lands.

The leaders in the industry realize that it is to their interest to keep forest lands in a productive condition. If clear cutting practices are followed, it may be 15 to 20 years before another cut, even for pulpwood, can be made. Thus it is to both the farmers' and the industry's interest to see that the farm woods are kept stocked and in good growing condition.

What is Needed?

An intensive educational program is needed to teach farmers and landowners how to handle their timberlands and how to obtain maximum returns per acre. Cuttings should be made on an integrated use basis with the timber being sold for the use to which it is best suited. Saw timber should not be sold for pulpwood unless the prices paid are comparable. Pulpwood sales should be made on a per cord or unit basis of wood cut.

The stands to be cut should be marked prior to cutting.

Foresters or timber estimators are needed who can render service to the small timberland owners at a cost commensurate with the values involved.

There is a definite place in the southern pulpwood program for pulpwood cut from farm woodlands. The industry has recognized this fact. Steps should be taken by the industry to see that the mills are not deprived of this source of wood.

Although pulpwood can be grown on fairly short rotations, it may be much more desirable for the farm woodland owner so to handle his forest as to produce other products as well. In the naval stores belt, for example, greater returns per acre can be obtained by combining turpentining with pulpwood, pole, piles, and sawlog cutting. In other portions of the region pulpwood may well be produced as an intermediate crop on short rotations, with saw timber as the final crop.

Unless sound cutting practices are adopted and unless protection from fire is afforded, the millions of acres of farm woodlands will deteriorate further, the income to the farm woodland owners will be reduced, and the pulp and paper in-

dustry will suffer through the loss of farm-produced pulpwood. The problem of keeping the farm woodlands productive concerns the other users of forest products, and these other users should be brought into the program.

The educational program needed may well be carried on by the various state and federal forestry agencies with assistance from the industry. The various state foresters and extension foresters in the South have made a beginning, but they are often handicapped by lack of personnel and insufficient appropriations. The county agents and vocational teachers in general are not forestry minded. Many of the county agents are so crowded with their agricultural programs that they haven't the time to undertake any forestry program, even if they were prepared to do so. They need outside help and encouragement from their extension directors and extension foresters in order to build up an adequate farm forestry program.

A forward step has been taken in Georgia. During last November a series of seven meetings was held in south Georgia at which the forestry phases of pulpwood production and marketing were explained to county agents, secretaries of the timber protective organizations, and vocational teachers. Instruction in pulpwood estimating, marking, and cutting was given through joint cooperation on the part of the Agricultural Extension Service, the State Forest Service, and the Division of State and Private Forestry of the U. S. Forest Service. Prior to these meetings a simple handbook covering the pertinent phases of forestry practice which a farmer might apply to pulpwood cutting on his woodlands was prepared. This handbook was given each man attending the meetings as a reference and further guide so that he could, in turn, pass this information on to the farm woodland owners.

It is too early to evaluate the results of these meetings, but they are mentioned in order to show that steps are being taken to get forestry information into the hands of the agencies who deal directly with the farmers. As a further follow-up it is planned to conduct marking and cutting demonstrations and to introduce other phases of farm forestry, such as naval stores practices, reforestation, and forest protection. When the farm woodland owners are shown that their farm woodlands can and should produce good net returns, a large supply of pulpwood will be produced. Intermediate cuttings, allowing for intermediate returns, will go far in supplying the pulp and paper mills with pulpwood.

THE PULP AND PAPER INDUSTRY IN RELATION TO FOREST FARMING IN THE SOUTH[1]

By MATT RUE

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The rapid development of the pulp and paper industry in the South may be regarded either as a benefit or as a menace to forestry practice in the South depending upon the individual's point of view. The writer of the following article, who has had twenty years experience in land management in the South believes it to be a potential benefit. Because of his background the writer understands the problems both of the operator and of the forest farmer. Many practical suggestions to encourage better forest practices are made.

IN presenting these views I speak for no pulp or paper company, or for any particular area of landowning interest. I am giving my own views concerning the southern pine belt. These views have been formed during some twenty years' experience with southern land management problems.

Much has been said and written during the past year or two regarding the pulp and paper industry as a potential benefit or a possible menace to the conservation of the pine forests of the South. I firmly believe this new industry is an asset and benefit to timber farming in the South, and that it will continue to increase in the benefits returned to land ownership over a period of time, provided the landowners can be induced to adopt reasonable views regarding conservation and utilization.

At the outset it may be said with assurance that there is a fundamental mutuality of interests between the pulp and paper industry and landowners. The industry supplies a long-needed market for low-grade timber; the landowner will have the benefit of the opportunity to furnish that raw material continuously. At the same time, the interests of the industry and of the landowners may be in opposition to each other. The industry wants a uniformly continuous supply of pulpwood of usable quality at a reasonable cost, whereas the landowners usually want a spot market on which to sell their pulpwood at a price sufficient to return at least a fair stumpage value, and in many cases, a more than fair return for the wood. Obviously, human nature is such that mill management is never satisfied with the profit it is earning currently, and likewise, a landowner can never receive enough for the forest product he sells. I am sympathetic with both views, and I believe the two opposing views eventually will be reconciled to the mutual benefit of both interests. For some years an effort has been made to impose a public interest on private forest lands. This is proper, but before it can be widely enforced the public must assume its share of the burden in recognition of the benefit it receives.

At the very outset the question naturally arises, "Is the pulp and paper industry a desirable and necessary facility to timber farming in the South?" My own answer to that question was reached years ago. It is a most emphatic "Yes."

If the pulp and paper industry is either desirable or necessary in the South, then under what wood procurement methods, and under what forest management policies and forest practices can it be economically and successfully operated, and at the same time be of greatest benefit to timber farmers and landowners in the

[1]Presented before the Forestry Section of the Association of Southern Agricultural Workers, Atlanta, Ga., February 3, 1938.

South? It is believed the answer to this question can be determined only through long study and the use of much common sense. If there is a mutuality of interests, the solution of the problems should be approached by the pulp and paper industry, the landowners, and the public agencies who are likewise interested, intelligently and in moderation, without preconceived prejudices.

First, I wish to take up briefly the position of the pulp and paper industry. The views of the industry should not be condemned too readily. The development of the pulp and paper industry in the South is in its infancy. The problems to be met are large and will prove troublesome before they are successfully solved. Paper mills have moved into the South because they believe the move is economically sound and that there is opportunity for long-time operations at reasonable cost. Unfortunately, most of the mills to date, either in operation, under construction, or projected, are what is known as "kraft mills." They make kraft paper for bags, and kraft liner and board for containers. These products are all in the low price class of paper and will not admit high costs. This branch of the industry is likewise very highly competitive, and because of the recent expansion there is likelihood of an over-production, further affecting the price of the finished product for some years ahead. Bleached sulphate mills are coming into the South; two are already here, and more will no doubt follow. These mills make a higher value product, but until the successful operation of such mills can be demonstrated, the entire cost structure must be maintained at a minimum. Likewise, we have one mill under construction in the South which proposes to convert pine pulpwood into cellulose to be made into rayon. The possibilities of further expanion seem very great.

The capital investment in plant and conversion facilities may run from as much as two and one-half million to six or seven million dollars. The average cost of most plants is from three to five million dollars. Inasmuch as the paper industry, along with all others, recently came through a severe depression, it is generally in an unfavorable position to finance such obligations. Financing of the capital investment on a sound basis has been most difficult. Where it is not properly financed on a long-time basis, there is grave likelihood of undue and improper pressure being placed on timber farmers in wood costs to enable the mill to provide for its amortization requirements. Very few mills even when soundly financed and when well planned operate successfully for six months at least after construction is completed. This may be due to defects or omissions in construction, to changes in mechanical or chemical methods after plant construction began, or to incompetent or otherwise inefficient or undesirable personnel.

After the trial period is completed, it may still require from one to two years to revise methods or processes so as to produce satisfactorily and economically the particular quality of pulp or paper in the quantity volume desired. During this period of development or of trial and error, if it may be termed such, the efforts of management must of necessity be devoted to conversion problems to the substantial exclusion of all other matters.

Usually each mill has a separate department in charge of all wood procurement and forest management activities. During the period of mill development the wood procurement division operates under previously determined and approved forest policies and practices. It is believed thorough analytical examination will show most of these policies to be sound. However, they also must be subjected to the trial and error method and they must be revised and modified during the first few years. Time will show a continuous improvement in both forest

policies and practices as the problems are worked out under operating conditions.

Furthermore, the wood procurement division is usually under considerable pressure to hold down costs during this period of trial and error while the mill management is working out the most economic methods and processes. As this pressure extends down the line of management it naturally increases until it reaches the individual dealing directly with the landowners or the public in his respective area. Consequently, the mill's policies and practices are no stronger or weaker, no better or worse than the particular individual's interpretation of them. Such deviations from sound policy as may result because of these circumstances can be corrected only slowly. It is quite unlikely that the personnel in charge at the beginning of wood procurement and forest management is ideal. No doubt there will be many changes made by each company to obtain better results.

On the other hand, present inadequate, inefficient, or incompetent policies or personnel are not to be too readily condemned. The Association of Agricultural Workers, which has so much to do with forming public opinion and with developing favorable or unfavorable attitudes toward the pulp and paper industry, is strongly urged to proceed with caution. Where inequities occur, the reason for them should be carefully analyzed and an effort should be made with the mill management to correct them. If there is no improvement after this has been done, and if reasonable educational efforts are unproductive, there is still ample time for regulation by law, if that seems to be the only way to accomplish desirable objectives.

It is believed that a program of education of mill managers will succeed where compulsive legislation will fail. Certainly, until our American ideals have undergone further radical changes, a small force engaged in educational work will accomplish more than a larger force engaged in policing compulsion.

Now, let us examine briefly the specific things which the industry can or should do in the sound operation of the southern forests for the mutual benefit of the mill and the timber farmer, while at the same time protecting the public's interest:

1. Each mill should, wherever possible, deal directly with the landowner to the exclusion of intermediate commission agents, brokers, or contractors. This is not possible in all cases and the method of procurement must be regulated largely by conditions within the economic area of each mill.

2. Each mill should at least enforce compliance with the minimum conservation rules and practices recently adopted by the mill owners. Wherever economically possible it should adopt even higher standards of practice.

3. Mills should attempt to get their wood supply only through improvement cuttings. This is not always practicable, because some forest areas have been overcut during the past ten to twenty years for other forest products such as sawlogs, poles, cross ties, and there remains nothing in the stand but defective mature timber. If the number of seed trees is adequate to insure reproduction complete cutting of all defective timber is recommended. In such cases the cutting would be in the nature of an improvement cutting, but it would result in practically denuding the land of mature but defective timber.

4. Each mill should promote sound utilization practices on all forests in its economic area. Better utilization practices within the economic area will result in greater stumpage returns to timber farmers because of lower transportation costs.

5. Where it is possible the mills should make first mortgage loans to good moral risks to insure a future timber supply. Many mills will not agree with this

suggestion because they prefer company land ownership rather than the mortgage risk. I believe time will show that diversification of brainpower and manpower in land management will prove more beneficial than company ownership of large areas. Such loans will provide the capital for sound forest expansion at reasonable interest rates. This suggestion also should be considered by the public agencies.

6. The forest or wood procurement division of each mill should render technical advice on forest problems to all the timber farmers in its operating area. An expansion of this service is badly needed.

7. Each mill should work in close cooperation with all public agencies for the public good. The mills should be leaders especially in forest protection and fire suppression methods and organizations.

8. Each mill should strive for closer control over its wood procurement activities to assure a maximum money yield to the timber farmers operating for and with each mill. Much has been said of stumpage prices recently. A large part of the difficulty seems to be that some mills are operating over too wide an area rather than seeking intensive but sound utilization within a smaller area. Where operations are scattered over 150 to 200 miles, close control is practically impossible and it further tends to diminish the returns to the timber farmers because of the higher transportation costs.

No doubt there are many other things which the industry should do. I have merely tried to point out some which I think would benefit the situation. I suggest wide thought be given this subject and that some agency such as the U. S. Forest Service Regional Office in Atlanta serve as a central clearing house where all proposals can be reviewed, digested, and coordinated. Ultimately this will result in the development of policies and practices mutually advantageous to the industry and to the timber farmers.

Now let us examine the landowner's viewpoint and consider his timber farming problems, particularly in relation to the pulpwood supply.

Fundamentally, the extent to which landowners may go in producing and protecting timber for all uses is related directly to the income or stumpage realization they can obtain from the forest products. In other words, the cash requirements of individual owners will largely regulate the degree to which forest conservation will be practiced. Consequently, it is in the interest of sound forestry to provide a maximum return to the landowner for the forest products he markets. This means a maximum return not only from pulpwood, but also from naval stores, sawlogs, poles, piling, cross ties, veneer blocks, and all other products. It is believed that the average return to landowners for other forest products has been just as low comparatively as for pulpwood, or, conversely, that the average return for pulpwood has been just as high comparatively as for other forest products. I have never heard of a naval stores operator paying 15 or 20 cents per face if he could secure it for 12 cents, or of a sawmill operator paying $5 per M feet International ¼ inch rule for sawlogs if he could buy it for $3 per M feet Doyle log rule. Hence, the conclusion must be reached in fairness that the pulp and paper industry is no better or worse than all other consumers of forest products. Demand for a raw material working through active competitive buying has always created price to the benefit of the seller in this country. So long as human nature is guided by past training, it will prove difficult to change the fundamental factor in buying.

However, this statement does not meet the problem or solve the question. Because of the large capital investment in a pulp or paper mill, it cannot cut out and move on as the sawmill industry has been accustomed to do. Paper mill manage-

ment must look farther into the future for its source of raw material. Hence, it is believed that the interest of the industry in the problems of the timber farmer will constantly increase and that it will attempt to solve them for the mutual benefit of both parties.

Landowners or timber farmers in the South may be divided into two general groups: First, the group owning several thousands or more acres. Forest products are the primary source of income to this group. Second, there is the group of farm wood lot owners. This group is very large and the aggregate area in such ownership is large.

Because the large landowners secure their primary income from forest products, the areas controlled by them are generally better managed than those controlled by the smaller owners.

The sale of forest products is usually a secondary or by-product income to small owners of farm wood lots. Too frequently, the farmer gives insufficient thought and care to his wood lot. He is more interested in a spot market for wood lot products when cash is required than in a continuous current income from the forest.

However, both types of ownership have the same common interest. They also cover as wide a range of rugged individualists as will be found in the paper industry. Their attitude towards forest management varies greatly. There are some aggressive sound-thinking individuals who are trying to operate their particular areas with care and thought; there are some poverty-stricken, indolent individuals who care nothing for tomorrow, but will sell everything today for what they can secure. Of course there are many between these two extremes.

Inasmuch as the problems involved are the same, little distinction should be drawn between the two groups of owners. There is a great need among all landowners for wider education through personal instruction. This burden should be assumed by the public agencies.

Specifically, timber farmers of the South should be interested in the expansion of the paper industry and should cooperate closely with it in order to benefit from the present and future market the industry provides. Among the suggestions to timber farmers I would include the following:

1. Each forest area should be operated on a sustained yield basis. Low interest rate loans will aid by reducing the economic pressure to overcut.

2. Each timber farmer should cooperate actively with the fire protection and suppression organizations in his respective area. The immediate danger of a diminishing supply of forest products lies as much in inadequate fire control as it does in overcutting.

3. Where possible, each forest area should be operated to yield a current annual return rather than a periodic return at intervals. Where the income is current and continuous it provides cash returns to meet costs of administering the forest. It also seems to emphasize to the timber farmer the value of conservative forest practices.

4. Where possible, each forest area should be operated under what is generally termed "integrated forest utilization." This is difficult in many cases, as no market exists for some of the products grown. In such cases I believe it to be the duty of public agencies and of the community generally to develop local markets, and more particularly, to advise and consult with landowners as to where the best markets for these products may be found.

5. Timber farming should be diversified as to the type of products to be grown. For example, where an area of advanced reproduction indicates the probability of a future pole supply, such an area should be used for producing poles. Likewise, with sawlogs and other higher

value products. However, in this diversification program the relationship of timber farm products to markets must be constantly borne in mind.

6. Where idle, unproductive land for either farm crops or timber crops exists, aid should be given timber farmers by public agencies to encourage the planting of trees on such areas. For some years the federal government has made seed loans to farmers. In recent years it has made other benefit payments to farmers either for growing soil conserving crops or for not growing crops at all. Why not loans or even outright grants for planting and growing timber as well?

7. If the pulp or paper mill nearest the timber farmer makes its wood procurement policy so the farmer can sell his product directly to the mill, he must be induced to assume the responsibility for good forest practices. It is believed that sound, conservative forest practices will be effected more readily where the woods operations are carried on directly by, or under the supervision of, the landowner, whose primary interest is in the income from the forest. Where woods operations are carried on by contractors or wood producers, whose primary interests lie in the operating profit, the forest practices carried out will be on a lower standard. In one case there is the subordination of operating profit to stumpage realization and in the second case the subordination of stumpage return to operating profit.

8. Where possible, each timber farmer should place his forest under a definite plan of management. Many timber farmers are now growing defective timber which will have little or no market value in the future. Such timber should be cut and removed from the land to permit the establishment of future forest growth of greater value.

In considering the entire problem it definitely should be borne in mind that the public has a substantial interest in the sound operation and conservation of forest areas. Practically every phase of life in the Coastal Plain region of the South will be dependent in the future upon the soundness of the policies developed, and upon their execution. Consequently, public agencies, both federal and state, as guardians of this interest, have a definite duty and obligation to perform. However, I do not think public agencies should be the guardians of the net income or realization to individual farmers any more than they should be guardians of the wood costs of the mills. As I see it, it is the duty of public agencies to develop sound policies of forest utilization which will lead to the proper solution of these problems, and to see to it that they are executed.

The public agencies also should concentrate on the improvement of utilization methods and of manpower, and of fire detection and suppression methods. These are the greatest needs in the timber belt today.

Beginning some ten or twelve years ago, the American Forestry Association has carried on an education program against fire in the South. This educational work was of great value and caused a considerable change in public attitude. Since about that time all of the silvicultural phases of forestry have been emphasized continuously. The interest of public agencies has become more active and intensified each year. Numerous organizations have sprung up, many of them of great value in having repeatedly emphasized the necessity for sound forestry measures. The activities of the Slash Pine Forestry Association of Waycross, Ga., are typical. This association's activities have been most beneficial throughout southeast Georgia. Dr. Charles Herty's efforts have been an important factor in awakening a consciousness for the necessity of fire protection. All of these activities, and especially the efforts of the field men of your association, have had good results. However, I believe we have

over emphasized the production and protection fields of forestry and have under emphasized the sound utilization of the forests we are attempting to grow. Much of the publicity given the subject has tended to create the impression among timber farmers that they should grow timber merely for the sake of possessing trees. There is danger in continuing this idea without emphasizing utilization. While, in the abstract, it may be fine to grow timber for the sake of possessing it, walking through it, admiring it, etc., we must remember that it costs money to grow a forest.

Sound utilization has been neglected in our forestry scheme. The Southern Forest Experiment Station has done a great deal during the past several years in the scientific investigation of timber utilization. It is essential that we have an expansion of the activities of the Southern Forest Experiment Station. Many of our utilization problems could be solved in a comparatively short time if we had studies in progress on each forest type. The past year or two utilization studies have been carried on in Arkansas in the shortleaf pine belt. It would be desirable to have similar work carried on in the naval stores and in the loblolly pine areas. Despite these needs, there is grave likelihood that the appropriations for the U. S. Forest Service, and particularly for the Southern Forest Experiment Station, will be reduced by the federal Congress in its current session. Such a reduction would result most detrimentally to the interests of forest conservation in the South.

An expansion of the activities of the state forest services would likewise have beneficial results. It is most difficult to reach the individual landowner through published bulletins and pamphlets. Public organizations would get far better results if they were financially able to set up sub-regional offices throughout the timber belt to establish close personal relationships with the timber farmers. We also need more stringent fire laws and better enforcement facilities for such laws. I wish to urge your association to work for the necessary appropriations and measures.

In closing, it seems desirable to point out that we are dealing with a matter of the widest public interest in the Coastal Plain region of the South. Not only are the pulp and paper industries, the timber farmers, and the public agencies interested in the successful solution of these problems; they affect practically all people and all industries in the timber belt. If we are going to develop a successful basic policy and carry it out, we must attack the problem with absolute integrity of purpose, forgetting self-interest and self-advancement for the public good. Sound thinking, a moderate and tolerant attitude, and close cooperation and understanding between the groups primarily interested will contribute greatly to the solution of this important and difficult problem.

THE University of New Hampshire will conduct its usual forestry summer camp beginning July 10 and ending September 3. This is intended primarily for forestry students in their junior year at the University, but others properly prepared may be accepted. The camp is located within the White Mountain National Forest in the valley of Swift River.

An innovation this year will be a special course in fish and game management under the direction of Earl Hoover of the New Hampshire Fish and Game Commission, assisted by other specialists. This course is open to all properly qualified, and will attempt to give practice in dealing with the problems in wildlife management. The resources of the University of New Hampshire, the hatcheries and equipment of the N. H. Fish and Game Commission, and the wildlife refuge of the U. S. Forest Service will be pooled to make the course comprehensive and practical.

THE LUMBERMAN'S VIEWPOINT ON THE FORESTRY PROGRAM FOR THE SOUTH[1]

By JULIAN F. McGOWIN

W. T. Smith Lumber Company, Chapman, Alabama

Foresters who wish to regard the lumberman to be the chief obstacle to, and the general public a militant supporter of better forest practices in the South should not read Mr. McGowin's article. To do so may necessitate a decided change in point of view. It would appear that many lumber companies in the South have gone about as far, if not farther, than the public has a right to expect them to go with the existing type of public cooperation. What chance has forestry when fences to keep out cattle are torn down and when incendiarism goes unprosecuted? Every reader may answer the question for himself.

IT is the purpose of this paper to show something of the part the lumber industry is playing in the progress of forestry development in the South, and to present some of the problems facing the manager of a commercial forest. Many people look accusingly at the lumber industry and wonder what steps it is taking to maintain and perpetuate the timber supply, particularly now since events in recent years have awakened a new public interest in forest conservation and management, because of its relation to soil erosion, flood control, climate, game supply, and recreation. If these values are important, and if it is desirable to perpetuate our forests, it would be decidedly helpful if it can be shown that good forest management is commercially profitable and attractive.

Lumber and other wood-using industries have developed examples of successful forest management. Methods are being constantly improved by technical advice from the Forest Service and by the experience of operators, but the local official and rural people who influence most directly the management of commercial forests are often still apathetic or even hostile.

The number of examples of successful forestry practice which industry can show are necessarily few. The era of exploitation from which we are emerging was not conducive to forest conservation and management. We now can see that much of this exploitation was wasteful, just as the exploitation of all other natural resources was wasteful.

Only a few years ago stumpage was plentiful and cheap, transportation was difficult, and under those conditions not many conservation measures were possible. The number of present day farmers who cut and burned fine timber to clear their fields testifies to this fact.

In recent years, however, values have changed. Forest products now find a ready market as sawlogs, poles, naval stores, or pulpwood. New locations for large sawmills are not easy to find and, wherever possible, existing mills are trying to lengthen the life of their operations.

In 1935 six sawmills in the South were certified by the Lumber Code Authority as growing more timber than they were cutting. These six companies owned just over one million acres of land. In addition, 137 sawmills and other industrial owners, controlling more than ten million acres of land, were listed as conserving growth for future use or making provisions for keeping their land productive. The interest in this development has been so great in the past three years that the Conservation Department of the

[1]Presented at the Forestry Section of the Association of Southern Agricultural Workers, Atlanta, Ga., February 3, 1938.

Code Administration has been maintained as an activity of the Southern Pine Association. This organization has worked unceasingly to inform lumber operators about the possibilities and methods of improving forestry practices. During the past three years those in charge of this department have visited almost every landowning mill from Virginia to Texas, and they report that practically all of them are now endeavoring, in varying degrees, to protect their lands and keep them productive.

At this stage of our development, forest management may be summed up as adequate fire protection and reasonable cutting practices to leave a growing stock of trees. Management plans must vary considerably according to the species, the condition of the stand, and the economic position of the company. A concern with a large plant and small remaining supply of timber obviously cannot hope for a sustained yield operation. In other cases the output of the plant has been adjusted to the growth of the forest. The Great Southern Lumber Company is about to close down its sawmill at Bogalusa, Louisiana, which is the largest in the South. This does not mean that the lands belonging to this company have been neglected. On the contrary, its forestry efforts go back to 1919, and it has 30,000 acres of pine trees which were planted by hand between 1920 and 1930. A subsidiary corporation operates a paper mill from wood grown on this company's land, and some of the company's second growth stands are already producing pulpwood and sawlogs.

In April 1937 there was held at Washington a Forest Conservation Conference under the auspices of the National Lumber Manufacturers Association. This conference was attended by representatives of eighteen industrial organizations and fourteen public agencies. Here the lumber industry pledged itself anew to the principle of sustained yield and offered its full support in obtaining proper forestry practices.

Since the beginning of the development of the pulp and paper industry in the South the paper companies have been careful to protect and manage their own land. During the last year they went a step further and adopted a set of rules to govern the pulpwood cutting done on land belonging to other people. These rules are designed to leave a growing stock on the cut-over areas.

It appears that the vast majority of all the forest land in industrial ownership in the South is now under some form of management. This, however, represents only a small percentage of the total forest area, probably not much over 10 per cent. There are more than 10,000 sawmills operating in the South, yet only a few hundred of them own or may hope to acquire enough land of their own for a sustained yield operation. The others must depend on logs and timber bought from landowners. In Montgomery, Alabama, the several sawmills, concentration yards, veneer mills, and other wood-using industries shipped a total of more than 75 million feet of lumber in 1937. Yet, so far as I have been able to learn, these mills own only a few hundred acres of forest land. This is not an unusual situation and it shows that landowners and mill operators are two separate groups. The business of growing timber is separate and distinct from that of manufacturing it into a finished product.

It seems now that there should be fewer sawmill units. The remaining mills, however, should be properly equipped to provide an adequate market for the products of the adjacent forests. This does not mean that competition would be eliminated, but it should help to preserve the present proportion of ownership. Forest industries will be in a much better position if their supplies are drawn from a large number of small landowners. Some large holdings are desirable, as is a cer-

tain proportion of government ownership, but it is to be hoped that the bulk of our forest land will continue in small, independently owned holdings. We have the experience of many European countries to show that such a distribution in ownership is possible. Les Landes, the naval stores producing region in France, is an especially fine example.

Who owns most of our forest land? Why has the South, as a whole, been so slow to realize the vast potentialities of its forests? Who causes the thousands of forest fires we see every winter? What should be done to assure proper care and management of our forests? Perhaps an answer to these questions can be found in the experience of commercial managers. Farmers, as a group, are the principal owners of forest land. Any state forester or district ranger will tell you that rural people set most of the woods fires. In the Gulf States for the five-year period 1932-1936 the Forest Service lists three chief causes of forest fires as follows: smokers, 19.4 per cent; debris burning, 10.9 per cent; incendiary, 47 per cent. This makes a total of 77.3 directly attributable to rural people. Obviously our efforts must be directed to these people if we are to achieve any measure of fire protection. Until fires can be controlled, no further forestry measures are possible.

In Walton County, Florida, a lumber company attempted for several years to protect the land it owned there. However, local people persisted in burning it, and finally this company was forced to abandon any further attempts at protection. In an adjoining county they were able to secure proper protection, and there is a fine stand of young trees to show for it. In Dixie County, Florida, a company fenced a 30,000 acre tract of land. There were many protests because this had been an open range for cattle. One man in particular protested—he owned forty acres of land and 700 head of cattle.

In Crenshaw County, Alabama, a fire guard caught a man in the act of setting fire to woodland belonging to a lumber company. This man had fastened a corn cob saturated with kerosene to the end of a piece of wire. Applying a match, he walked through the woods setting fire as he went. In this case the probate judge generously offered to impose a fine provided the State Commission of Forestry would pay all court costs and agree to remit the fine. The following year (1936) this same man was seen starting another woods fire. Brought to court again, the defense of his lawyer was that the woods had always burned, so the judge would not convict him. If the cause of forest conservation suffers in those counties, who is to blame? In the adjoining county of Butler in Alabama the officials expressed their determination to enforce the law. Here excellent progress has been made in fire protection, and yet the fines imposed amount to only $20 in two cases. The knowledge that the law will be enforced is enough.

It cannot be emphasized too strongly that the success of any private or statewide forestry program in the South is dependent on the sympathy and cooperation of the rural people. A classic example happened in western Louisiana some years ago. A lumber company fenced twelve sections of land in order to protect it from fire and practice some form of forest management. In one night this three-strand barbed wire fence was cut at practically every post by neighboring people who resented losing the use of this land. Many other such examples might be cited from every part of the South.

The state extension services are the logical agencies to do a large part of the educational work necessary, and it is difficult to understand why this organization has not made greater efforts to make farmers conscious of the possibilities of their forests. Mr. Arthur O. Weidelich,

in his paper read to this association last year, called attention to this fact. Also, it might be asked if it is logical to make benefit payments in the name of soil conservation to farmers who permit their woodlands to burn. The Federal Land Banks are government agencies which have loans on thousands of southern farms. The company with which I am connected has made many timber purchases in the past few years which had to be released by the Federal Land Bank and the proceeds applied to the landowner's note. Would it not be practical for the Federal Land Bank to specify or require some form of selective cutting? Instead, we are generally required to cut everything eight inches and larger.

Farm forestry should not be difficult to promote, for actually it appears that the farmer would have considerable advantage over a commercial forest in growing timber. For large holdings the chief items of expense are: taxes, fire protection, cost of patrolling the land to prevent theft, and overhead. The farmer would have very little, if any, expense for the last three items and generally the ad valorem tax assessments are less against farmers than for larger landowners. A tax assessor in Alabama remarked that no land in his county had timber on it until it was sold to a sawmill. One lumber company which bought several thousand acres in the past two years to consolidate its holdings found that in every purchase the valuation of the former owner was less than the assessment against the corporation.

Patrolling land against theft is a serious and necessary expense. In some places it is difficult to obtain a conviction for timber stealing. Lightwood, staves, dogwood, cedar, and other forest products which bring a high return are very tempting to some log haulers and truck drivers.

The only disadvantage to the farm woodland owners would be in marketing the products sold. This has been met in other countries by the formation of cooperative associations.

Regardless of whether the forest owner is a farmer, private individual, or corporation, the three conditions necessary for future development of our southern forests may be summed up as:

1. Fire protection.
2. Fair taxation.
3. Some security for forest ownership.

Support from organized agriculture can play an important part in bringing this about. The industrial owners are developing the technique of management, but only an informed public opinion can meet the public obligations involved and remove the existing barriers to better care of our forest land.

LINCOLN CROWELL, a Senior member of the Society, and Massachusetts state forest fire warden for the Cape Cod district for the past 14 years, was killed April 5 when his automobile was struck by a railroad train.

He obtained his B.S. degree in forestry at the University of Maine in 1906, and his M.F. degree from Yale in 1907. He had also attended the Biltmore Forest School for a short period, and had made a tour of the forest regions of Germany in 1912. Prior to entering state service in Massachusetts, he had been with the U. S. Forest Service and the Indian Service. He was 55 years old.

RELATION OF GROWTH CHARACTERISTICS OF SOUTHERN PINE TO ITS USE IN PULPING[1]

By C. E. CURRAN

U. S. Forest Products Laboratory[2]

The Forest Products Laboratory has been a pioneer in the study of the pulping possibilities of southern pines. For over twenty-five years this important agency has studied the problem, and present developments in the South are a direct outgrowth of its work. In addition to demonstrating the fact that the standard pulping processes are applicable to southern pines, the work of the Forest Products Laboratory has established many relationships between the growth characteristics of a given species and the properties and value of the pulp produced. The best grades of pulp are produced from trees that have not grown too rapidly, that have a definite proportion of springwood to summerwood, and that have few knots. In other words, forest management practices have a profound influence on the value of the southern pines for pulping purposes. If the southern paper industry wishes to have an adequate supply of quality pulpwood it must be ready and willing to pay a premium for such wood. Even now it would appear to be a sound business practice to do so.

THE current expansion of the pulp and paper industry in the South gives rise to varied expectations according to the experience, background, or personal interest of the observer.

The proponents of an industrial South view the spectacle of new and larger pulp mills with justifiable optimism, considering the investments which they bring, the jobs which they provide, and the income and taxes which they contribute, all built on a foundation of widespread pine resources. In contrast, a certain degree of anxiety may be felt by those industries with which the pulp mills will compete for wood. Foresters, too, have expressed some concern about a situation that might mean the progressive destruction of young pine stands and ultimate loss of all the values they represent.

Both points of view must be fully considered. Undoubtedly this development will contribute much to the prosperity of the southern states. It is going to bring money into the pockets of the farmers and timber producers and to the laborers who find work in the mills. Just as surely, unless timely action is taken, it is going to create a lively hazard of denuding the very forest lands whose rich promise induced the mills to come south in the first instance.

The latter result would disappoint the hopes of many people, including those of us who have made the pulping of southern pines almost a life-time study. More than 25 years ago the Forest Products Laboratory conducted pioneer investigations in the then new sulphate process as it applies to southern pines, and we feel that our work has been a potent influence in the tremendous growth of the southern industry that has followed the use and adaptation of that process. In subsequent research we have developed methods of making white papers from the pines. We have participated in the current experiments relative to newsprint production from southern woods, including the use of semibleached sulphate pulp, which we consider the most promising answer to the whole southern newsprint problem. Throughout the course of these and many other experiments our view has always been toward the development of southern pulpwood resources not as a

[1]Presented at the Forestry Section, Association of Southern Agricultural Workers, Atlanta, Ga., Feb. 3, 1938.

[2]Maintained at Madison, Wis., in cooperation with the University of Wisconsin.

bonanza for quick exploitation but as a productive and self-renewed asset of the country.

As a member of the Forest Service I believe—and I think you share our belief—that by a proper approach to the problem, by suitable steps toward conserving, harvesting, and reproducing the forest growth, adequate supplies of wood for any reasonable utilization can be assured. Such steps will provide a permanent source of income to the farmer, the landowner, and the community. This is the forest crop principle, the issues of which are squarely before us today. In establishing the crop system, the information and influence which agricultural extension workers are able to bring to bear will be very nearly all-important.

A prerequisite to intelligent management of any crop is an understanding of the use value and possibilities of that crop as affected by its manner of growth; and it is my purpose to throw a little light on this question with respect to the pine wood crop and what it is good for in pulping processes. Both the farmer's interest in a profitable woodlot and the industry's interest in a permanent and adequate wood supply rest on one basic conception. This is the realization that wood, like any other natural product, is variable in growth characteristics, and that such characteristics are just as important in the use value of wood as in any other farm crop—spring wheat and winter wheat or sea-island and upland cotton, for instance.

It is common fallacy, even among those who should know better, that "wood is wood," and that little difference exists between trees. Everybody admits, of course, that there is a difference between hardwoods and softwoods, that some species grow larger than others, that clear lumber is better than knotty lumber, and so on. The general tendency, however, is to assume that all loblolly pine, for example, will exhibit the same properties and be suitable for the same uses. Fortunately or unfortunately, this is not true.

Pine trees now growing on southern farm woodlands and in the country at large constitute a source of raw material from which can be made all the types of paper used in the United States. Their varied possibilities arise from the different ways in which they respond to conditions of site, soil, and spacing, being evidenced in a good many ways—among which I wish to call special attention to the following:

1. Fast or slow growth, represented by wide or narrow annual rings.
2. Differing amounts of springwood or summerwood in the rings.
3. Differing amounts of sapwood or heartwood in the tree.

Everyone who has cut or handled pine—longleaf, shortleaf, slash, or old-field loblolly, is familiar with these differences, and I think you will easily credit the conclusion that they are effects of individual tree growth rather than strictly species characteristics. It is these that carry over into the character of the pulp produced. Of course, if there is some one species that you favor against all others, you are doubtless backing a winner. But be sure of the type of growth you want in that species and the kind of paper in view, and work toward them. By proper attention to them it is possible to set up in advance the raw materials best suited to the different pulping processes and products.

Except in a most general way, it is not my province to go into the conditions and cultural practices which develop these various characteristics; in the South this is a special field of the Southern Forest Experiment Station, in cooperation with which we are conducting some very interesting studies. I want to consider the raw product as it exists and point out some of its papermaking possibilities.

Heretofore the necessity for considering these matters has not been so evident. The reason is that up to the present time

practically all the pulp produced in the South has been of the so-called brown-kraft or sulphate type. In this process the wood, reduced to the form of chips, is treated with an alkaline cooking liquor consisting of sodium hydroxide and sodium sulphide. The process gets its name, sulphate, from the fact that in the important step of recovering the cooking chemicals sodium sulphate is employed. Sulphate liquors are alkaline. They dissolve the resins and readily pulp both heartwood and sapwood. Springwood and summerwood behave differently, but with the ordinary run of material a conglomerate pulp can be produced which is entirely suitable for the paper board, the wrapping and similar coarse papers for which southern pines have been so successfully used.

But the picture is changing. Paper technologists as well as the public are acutely aware of the trend in the South toward bleachable sulphate pulps for book and bond and possibly for newsprint papers. At least four mills are operating or are in the process of construction with the production of bleachable sulphate pulp in view, and if these developments are to be permanently successful greater care will need to be exercised in growing or selecting the raw material. For one thing, in the interest of smooth or closed sheets, it is desirable that relatively high proportions of thin-walled springwood be employed. Another point to be observed is to secure wood of relatively low heart content free from decay and low in resin, as these factors influence color and bleach consumption. In general a wood of different quality is necessary for the bleached pulps than for pulps used in coarser paper grades.

Then there is the exciting possibility of applying the sulphite process to southern pines; this means newsprint and all manner of white paper products—even rayon, which is actually the first objective at Fernandina, Fla. In the sulphite process a solution of bisulphite of lime in mixture with sulphurous acid is the pulping agent. As ordinarily applied, acid sulphite liquors will not reduce heartwood and are powerless to remove resins. It is true that the unpulped heartwood, which is recovered as so-called screenings, can be converted into boards by additional processing, but it is much more desirable that this low-grade by-product be eliminated if possible through the use of wood containing a minimum amount of heartwood, and that it be low in resin content. In sulphite pulping it is also highly desirable to use material having a relatively high content of springwood. Our experiments have shown that the pulp strength increases proportionately with the amount of springwood present, a fact that is somewhat curious as well as important, as we shall see later. This type of fiber also improves the uniformity and smoothness of the sheet surface, which is of prime importance in printing or writing.

A third pulping method, and one which must be thoroughly developed if southern pines are to be used for newsprint, is the mechanical process. Here the wood is reduced to pulp by the use of a grindstone. For newsprint, sulphite pulp is the "binder" and groundwood is the "filler." A pulpwood of good color is essential if groundwood pulp of satisfactory properties is to be secured, and again it is desirable that the wood have a relatively high proportion of springwood for the best results. The proportion of heartwood is of little importance so far as strength properties of pine groundwood pulps are concerned, but since heartwood is usually of a relatively dark color the presence of much of this type of wood is immediately reflected in the color of the pulp. Resin content is also a factor here. A high resin content is bound to result in a "pitchy" groundwood pulp, which will eventually cause operating difficulties on the paper machine.

With the exception of the mechanical process, all the methods used to reduce wood to pulp require a chemical action which is largely a solution of the lignin and noncellulosic components of the wood, releasing in purified form the cellulosic fibers. One of the conditions necessary for uniform chemical action is a uniform raw material. For this reason it is rarely practicable to pulp mixtures of species or even widely varying types of the same species. If enough energy is applied to reduce one type of wood, too much action on the other type present destroys much of its inherent value.

In the case of the southern pines, particularly those of extremely rapid growth, conditions are frequently encountered where the springwood and summerwood are so unlike as to be the equivalent of two different species. The springwood fibers are thin-walled and easily amenable to the action of the pulping agents. They are likewise much more easily processed after the pulp has been prepared from the flat, ribbonlike fibers. The summerwood fibers, on the other hand, are thick-walled and hence stiff and resistant to reduction and processing. Hence arises the seemingly strange fact that a stronger pulp is produced from the slenderer, inherently weaker fibers; they "felt" together better.

Of course both springwood and summerwood fibers are invariably present in southern pine. This disadvantage, however, can be overcome if the quantities of each are relatively constant. Difficulty arises when the proportions vary from batch to batch. Inevitably, under such conditions, a nonuniformity of pulp results unless the mill operator can adjust his operations to the particular batch being cooked. This is by no means a simple matter.

There is another characteristic of the rapid growth wood now coming into the southern stands which requires rather careful consideration. This is the so-called compression wood, which we have recently found has a definite bearing on pulp quality. Compression wood apparently arises from some state of strain during growth, as when the tree leans from the vertical. Regardless of what method is used to pulp this material, the resulting pulp and paper is of subquality. We believe this is due to a special kind of twist in the internal structure of the fibers; but, regardless of what is the cause, the fact remains that such material is of low value. Extremely rapid growth almost invariably results in a certain amount of compression or abnormal fiber, and hence it appears that forest management methods directed too exclusively to fast growth are not conducive to a yield of high-grade pulpwood.

There are certain other factors having a bearing on the utilization of wood at the pulp mill. Generally speaking, any material less than 4 inches in diameter is uneconomical; first, because of difficulties in removing the bark, and, second, because of the large number of sticks which must be handled in preparing the chips.

Knots must always be accounted an impairment of the value of pulpwood in proportion to their size and number. The knot fiber is usually dense and hard to penetrate with cooking liquors; no species surpasses the southern pines in this respect. The knotty parts of the chips have to be removed from the pulp mass by screening. They are not necessarily a total loss, as it is the custom at many mills to dump in the screenings with the next cook, but knots are not what the pulpmaker primarily intends to buy as raw material. They are, so to speak, the flies in his ointment, which he must strain out. The careful grower, however, will take pains not to produce too many of them. Much, we know, can be accomplished toward their elimination by prop-

er planting, thinning, and pruning of the stand, which with your help, we hope to see widely established in practice.

The weight of the wood is important to the pulp manufacturer. The denser the wood the greater the weight yield of pulp per cord, other things being equal. An exceptionally dense piece, however, is likely to be filled with pitch or to be so resistant to the action of chemicals that the final yield of pulp and the quality of the fibers will be less than would be obtained from a somewhat lighter material.

So far as the mill is concerned, no risk is involved in buying by the cord, as the net weight of actual wood in the average cord of pine of a day's run holds fairly steady. From the point of view of the individual grower, however, the case is different. Purchase by the cord offers no premium on selection or on the production of dense wood by careful growing methods. On this basis, an exceptionally good lot of wood might bring no more than 50 or 75 per cent of its inherent value, while light-weight stock brings more than it is actually worth as a source of pulp.

The alternative system of purchase by weight on delivery has recently been inaugurated at one or two mills. Such a system is worthy of the careful consideration of owners in any steps they may take toward organized growing and marketing of pulpwood. It would insure every load of wood bringing its proper return at the prevailing scale of prices.

In view of the whole pulpwood-growth picture, which I have sketched only briefly, and in the barest details, one central impression emerges, and that is that if the woodlot owner is to make the most of his timber farming he will attempt to supply the type of material which the pulp mills can best utilize. In so doing he can demand a premium for his product. To some extent he can actually specialize his growing practice, and in any event he can hold back material which is not well adapted to any pulping process and can divert it to one of a half-dozen other uses.

Generally speaking, the best pulpwood will be relatively uniform in growth, which means that the thinning of the wood lots will need to be so handled that extremes of growth rate are not encouraged in any given stand. Despite weight requirements, a relatively high ratio of springwood to summerwood is desirable and can also be regulated by the thinning practice. If the wood contains much heart, it is obviously not suited for sulphite pulping and can be best disposed of to mills operating the sulphate or other alkaline process. The same holds true for groundwood, except that if the heartwood is not dark in color it can be utilized in this process.

Before concluding these comments perhaps a word should be spoken about hardwoods. The recent Forest Survey figures show approximately half the existing stands to be of this type. The Forest Products Laboratory has studied these species as pulpwoods, evaluating their grinding possibilities, their use in sulphite and sulphate pulps, in the production of newsprint, book, bond, and many other grades of papers. A few years ago we even developed a new semi-chemical pulping process now used successfully in the pulping of gum and chestnut for fiberboards and other papers. With conditions as they are the economics of utilizing southern hardwoods for pulp are somewhat hazy, but a limited use is already an accomplished fact, and as our efforts with the pines approach a successful conclusion more intensive effort is being directed toward the hardwood species. We feel confident that they, too, will find a prominent place in the general wealth of pulp resources with which the South is endowed.

For his own interest and the larger wel-

fare of the South, the farmer should be made aware of the possibilities of pulpwood as one part of his timber program. With the industry heading South, competition in the purchasing of pulpwood will increase. Other things being equal the price should follow a rising trend, and in all fairness the mills can afford to pay the higher price for pulpwood if the quality of the material which they receive is such that they may realize higher yield and better pulp quality.

Shelterbelt Plantings for 1938

FARMERS in the Plains States are asking for increased planting of shelterbelt strips under the Prairie States Forestry Project. Plantings under the project, authorized by Congress last year, are a continuation of shelterbelt planting begun in 1935 with emergency funds.

In six states 4,300 miles of shelterbelt plantings have been allotted for 1938, about 60 per cent more than were planted in the three previous years. Shelterbelt mileage quotas for 1938 are: North Dakota, 350 miles; South Dakota, 400 miles; Nebraska, 900 miles; Kansas, 800 miles; Oklahoma, 1,050 miles; Texas, 800 miles. The 38 million trees needed this year are produced and planted by the U. S. Forest Service. Farmers fence the shelterbelts where necessary and cultivate the young trees at least three times a year for two or three years until the trees are large enough to form a canopy. In the southern parts of the project cultivation generally is not required after the second year.

The native cottonwood and the Chinese elm have made the greatest and fastest growth. These two species are chiefly used for the center rows of the shelterbelts with ash, American elm, hackberry and locusts in intermediate rows. The Forest Service reports that good young trees from proper sources, properly planted, protected, and cultivated have made it possible to obtain relatively high survivals of tree belts even with drought, which in 1936 was most severe. The average survival for the six states for all plantings to date is 70 per cent of the 44 million trees which have been planted. Tree planting in the shelterbelts is no more expensive than planting in any other area, except for the cost of cultivation. One acre of shelterbelt will protect about 20 acres of crop land from wind at a cost of about 4 cents per protected acre per year.

USE OF INDOLEBUTYRIC ACID TO STIMULATE THE ROOTING OF DORMANT ASPEN CUTTINGS

By ALBERT G. SNOW, JR.

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The realization of the importance of planting to the successful achievement of the objectives of many conservation programs has led to increased emphasis on the development of suitable planting methods and the low-cost production of stock. Vegetative propagation offers a means by which these problems can be solved, at least in part. Another use of vegetative propagation is as a forest tool for the immediate use of excellent hybrids and selected superior individuals or strains found in the natural forest that must be multiplied as clones to maintain their inherent characteristics. Indolebutyric acid was found to stimulate greatly root formation of dormant cuttings of large-toothed and trembling aspen.

OF the many ways in which forest trees may be propagated vegetatively, such as root sprouts, layering, grafting, and cuttings, the method most likely to succeed in the low-cost production of stock on a large scale is the use of cuttings. As a number of forest species normally root poorly from cuttings, some procedure such as chemical treatment must be found that will increase the percentage of cuttings rooting. It was this need for a method of multiplying certain species and white poplar hybrids as a clone that led to the investigations reported in this paper (8).

As a result of the fundamental work of Kögl, et al (6, 7), Thimann, et al (9, 10), and Went (12, 13, 14), the use of such indole derivatives as indolebutyric and indoleacetic acids as growth stimulators has received much attention. The application of these substances in stimulating root production on cuttings has been further encouraged by Cooper (1, 2), Hitchcock and Zimmerman (4, 5), Zimmerman, et al (15), and others. In attempting to root cuttings of woody species these workers have been partially successful with some species of such genera as *Acer*, *Ficus*, *Ilex*, *Malus*, and *Taxus*. Their efforts have been concerned mainly with the treatment of greenwood cuttings

The work reported here was considered necessary as no reference was found that dealt with the chemical treatment of dormant aspen cuttings with indole derivatives. Under normal conditions dormant cuttings of either large-toothed aspen (*Populus grandidentata* Michaux) or trembling aspen (*P. tremuloides* Michaux) are difficult to propagate vegetatively, seldom rooting more than about 1 per cent under nursery conditions. Experiments conducted in conjunction with the project of forest genetics at the Northeastern Forest Experiment Station indicated that dormant cuttings of these species taken at the proper time can be rooted to the extent of about 65 per cent by the optimum chemical treatment.

Methods Employed

Over 2,500 cuttings about six inches in length were taken at various intervals during their dormant period in late winter and early spring and treated with different concentrations of indolebutyric or indoleacetic acid for varying lengths of time. The concentrations varied from 1 to 80 milligrams of acid per liter of water, and the time of treatment from 8 to 166 hours.

The cuttings were secured from one-year stump sprouts growing near Mount Carmel, Conn. These sprouts were immediately transported to a greenhouse

[1]Maintained in cooperation with Yale University at New Haven, Conn.

and cut in lengths of six inches, with a clean, angular cut of about 45 degrees at the basal end. After immersion of the basal ends of the cuttings in about one inch of the chemical solution for the specified length of time, they were planted to a depth of about four inches in a sand or peat-sand mixture. Though steam pipes were below the propagating benches, the sand temperature seldom exceeded that of the air by more than two degrees, with the air temperature ranging from 60 to 75 degrees Fahrenheit throughout the course of the experiments. From 10 to 50 cuttings were used in each group. Although the number of cuttings was rather small to cover the full range of conditions studied, the results are believed significant because of the large per cent rooted with treatment as compared with the controls.

In addition to the regular treatments so far described, several series were run using one or the other of two types of cuttings illustrated under *A* in Figure 1. On one type two slices, extending through the cambium layer to the xylem, were made on opposite sides of the basal portion of the stem prior to chemical treatment. On the other type of cutting, several notches were cut in the sides of the basal end before treatment with indolebutyric acid.

Results

Indolebutyric Acid Treatment.—The results of this study indicate that, aside from the proper chemical treatment, the most important consideration for securing optimum rooting of dormant cuttings of aspen is the relative seasonal period these cuttings are made. This is brought out by comparison of Tables 1 and 2. Table 1 indicates that when the cuttings were taken during the latter part of January and early in February negative results were secured in most instances, although chemical treatment did increase rooting in five cases, the highest being about 30 per cent and the others 17 per cent or less. On the other hand, when the cuttings were taken at the end of the dormant season during the latter part of March, just as the leaf buds were beginning to swell, the per cent of rooting secured with chemical treatment showed positive results in nearly every case. Cuttings collected at this time rooted more than 45 per cent in six of the various tests, with one treatment causing more than 66 per cent of the cuttings to root. The controls only rooted on an average of about 5 per cent. The type of roots illustrated in Figure 1 is typical of the results secured in these later series. The poor response of cuttings collected and treated during the earlier period is illustrated in Figure 2.

Table 1

ROOTING OF ASPEN CUTTINGS TAKEN THE LATTER PART OF JANUARY AND FIRST PART OF FEBRUARY

Length of treatment	Concentration of indolebutyric acid (milligrams per liter) 5	10	20	40	80	Tap water controls
Hours		*Percentage*				
8	....	0.0	0.0	0.0	0.0	0.0
18	0.0	0.0	0.0	30.0	....	0.0
22		0.0	0.0	0.0	0.0	0.0
44	0.0	7.0	17.0	2.0	....	6.0
66	....	0.0	0.0	....	....	0.0
90	10.0	0.0	0.0	0.0	0.0	0.0
166	....	0.0	0.0	0.0	0.0	0.0

Table 2

ROOTING OF ASPEN CUTTINGS TAKEN THE LATTER PART OF MARCH JUST AS THE LEAF BUDS WERE BEGINNING TO SWELL

Length of treatment	Concentration of indolebutyric acid (milligrams per liter) 1	5	10	20	Tap water controls
Hours		*Percentage*			
22	13.3	26.8	53.3	46.7	0.0
27	....	50.0	66.8	....	5.0
46	46.8	40.0	26.7	20.0	0.0
51	....	50.0	6.7	....	6.7
70	20.0	20.0	20.0	26.8	8.9

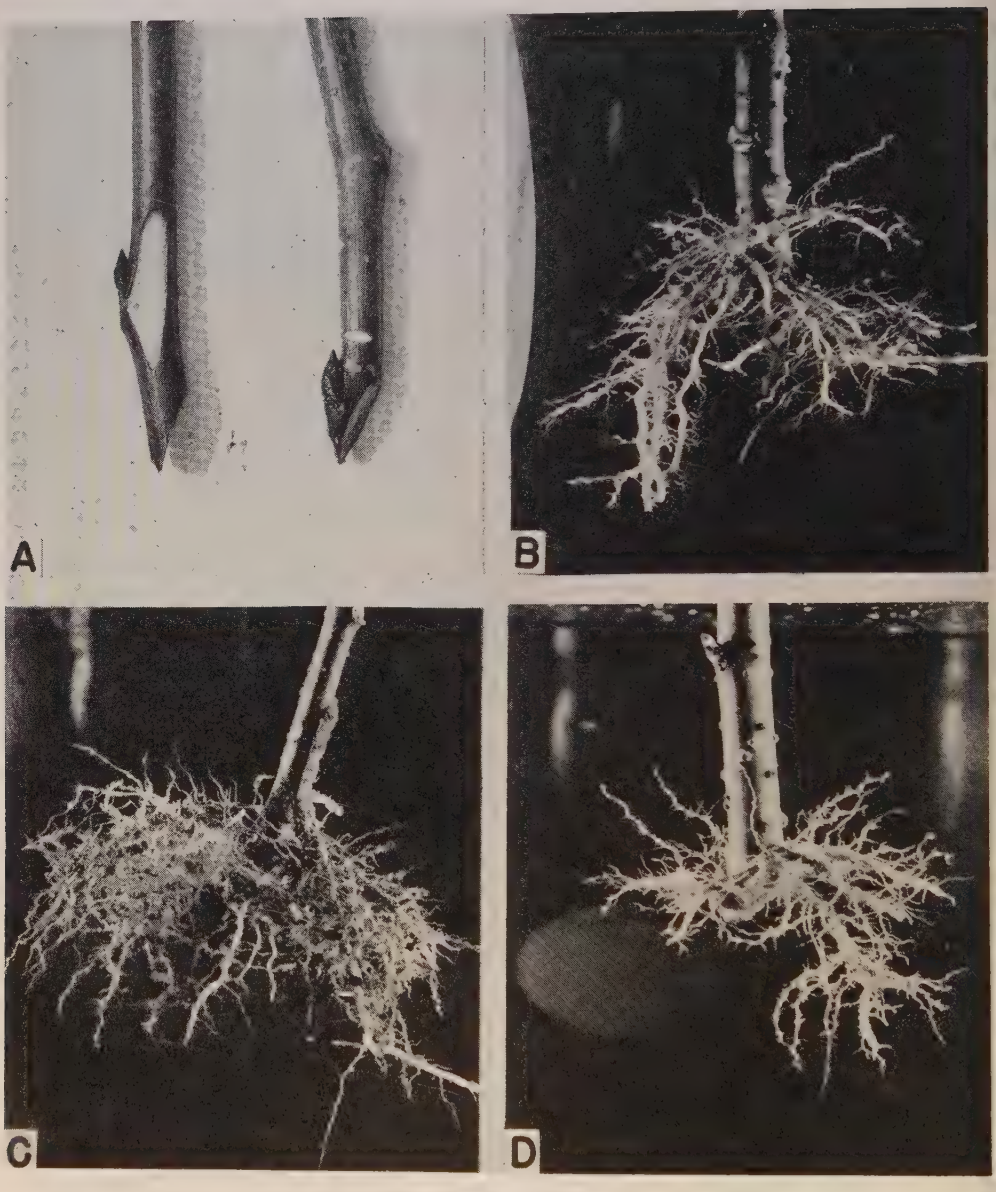

Fig. 1.—Dormant cuttings of large-toothed aspen 55 days after being treated with 10 mg. of indolebutyric acid for 27 hours, following "slice" or "notch" treatments. These cuttings were taken just before the buds burst in the spring; about 50-65 per cent of the treated cuttings rooted, in contrast to only about 6 per cent of the untreated controls. *A*. "Slice" and "notch" methods of pre-treatment; *B*. good root formation on a notched cutting; *C*. excellent root formation on a sliced cutting; *D*. fair root development on a normal, treated cutting.

Fig. 2.—Dormant cuttings of aspen 25 days after treatment. These cuttings, taken the latter part of January, rooted on an average of about 15 per cent with treatment and about 3 per cent for the controls. *A.* large-toothed aspen cuttings, the four on the left treated with 20 mg. of indolebutyric acid for 66 hours and the four on the right untreated controls; *B.* end view of callous on the same cuttings as in *A*. *C.* excellent callous on treated cuttings which finally rotted, with no roots being produced; *D.* typical treated cuttings of *Populus grandidentata* with good top and poor root development; *E.* typical treated cutting of *P. tremuloides* with good top and poor root development.

From the tests performed under the conditions of these experiments, it appears that the most uniformly effective range of chemical treatments lies mostly within 5 to 20 milligrams of indolebutyric acid for approximately 22 to 51 hours. Maximum rooting of cuttings occurred when they were treated for 27 hours with a solution containing 10 milligrams of acid per liter. The cuttings given this treatment not only rooted to a greater extent but also appeared to be more vigorous than any of the others. It is interesting to note that, within certain limits, the use of weaker concentrations of this chemical, for a longer time than the treatment giving maximum rooting, caused practically equivalent percentages of rooting. The same general trend is evident with a stronger concentration for a shorter length of time. This is depicted in Table 2, which shows almost equally good results from either a treatment of 10 milligrams per liter for not more than 27 hours, or from treatments of 5 milligrams or less per liter for at least 27 or 46 hours. However, these other possible treatments are often toxic in nature and attended with numerous adverse effects, such as "burning" of the stems and leaves, and the inhibition of bud development.

There appeared to be no significant difference between the per cent rooting of trembling and large-toothed aspen cuttings in these experiments, although slightly better top development was noted for the latter.

Indoleacetic Acid Treatment.—Although indoleacetic acid did stimulate to a limited extent the rooting of aspen cuttings taken during the latter part of January and early in February, results secured with this chemical were not nearly as satisfactory as those obtained with indolebutyric acid. Only 10 per cent of the two series of cuttings treated with 40 or 80 milligrams of acid per liter for 40 hours rooted, while the results of all other treatments were negative. However, no tests with indoleacetic acid were made with the cuttings secured in March, and future experiments with cuttings taken at this time should be undertaken before discarding this chemical in favor of indolebutyric acid.

Rooting Medium.—For the rooting of aspen cuttings, a fairly course sand was found to be superior to the peat-sand mixture. Vekhov (12) found that in the propagation of woody cuttings the best substratum was a pure, washed, coarse-grained, quartz sand. This type of medium is more easily penetrated by air, more sterile, a poorer conductor of heat, and is less likely to be toxic from the standpoint of acidity. The peat in any mixture is more likely to prevent adequate aeration, cause more rapid heating, and produce acid conditions incompatible with the normal development of specific types of cuttings. In a study of different types of rooting mediums, Hitchcock (3) found that every generus had specific requirements as to acidity, aeration, etc. There also seems to be an optimum moisture balance that must be maintained to secure optimum rooting, too much moisture causing early rotting of callous before roots are formed, and too little moisture retarding the growth of the callous until food reserves in the cutting are greatly depleted.

Significance of Callous.—In following the development of the treated cuttings it was noted that, although excellent callous formed at the basal end or along any cut surface where the cambium was exposed, as illustrated in Figure 2 under *C*, this was not indicative of potential root formation. Even though abundant callous occurred, if roots were not formed within about 30 to 40 days, the callous tissue turned brown and finally rotted away.

Pre-treatment of Cuttings.—It is possible that, by exposing more of the cambium of a cutting to the action of the growth substances by slicing or notching (Fig. 1), an increased stimulating effect would be produced. Although the results of the preliminary trials were no

entirely conclusive, excellent rooting of the pre-treated cuttings occurred equal to the highest percentages given in Table 2, and it is believed that some such treatment may still further increase the rooting of cuttings of these species. These preliminary experiments seemed to indicate that notching the base of the cuttings increased the per cent rooting. More work along this line is desirable.

White Poplar Hybrids.—Over 1,500 cuttings of several new white poplar hybrids were treated similarly to the aspen series. The results were variable, some rooting to the extent of about 70 per cent, while in others no rooting was secured. Further work with dormant cuttings of these trees is necessary before any definite recommendations can be made.

Summary

This study indicated that (1) dormant cuttings of trembling and large-toothed aspen can be rooted to the extent of at least 65 per cent by treating with 10 milligrams of indolebutyric acid per liter for about 27 hours; (2) maximum rooting is secured when dormant cuttings of these species are taken just before the buds are beginning to burst in the spring; and (3) abundant callous is not indicative of potential root formation.

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TOOLS AND METHODS IN AN EXPERIMENTAL PRUNING OF WHITE PINE

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The results of the study here reported show: the superiority, by virtue of lower time-costs, less tree injury, and greater labor safety, of certain tools and methods of using them for pruning dead limbs of northern white pine, with evidence that timecost need not increase with height from the ground, except as limb size increases; why selection of workers is as important as choice of tools; and that stand density has little effect on artificial pruning of this species.

THE advantage of some thinning of the forest is generally recognized today, but the old problem of whether or not forest tree pruning is practical is still unsettled. Differences in results from artificial and natural pruning, variations in the healing of pruning wounds on different tree species due to season of wounding, inherent species characteristics, and even the once thoroughly settled point of closeness of pruning to the bole, are all more or less unknown. There is, however, a growing acceptance of the belief that some pruning is desirable for improving the future quality of lumber, especially for such valuable species as northern white pine (*Pinus strobus* L.) on which dead limbs persist for 30 to 50 years or longer.

In spite of the lack of definite information state and federal stand improvement work of the last few years, performed chiefly with Civilian Conservation Corps labor, has included more and more pruning, and the need for accurate information on these matters is daily more urgent, particularly since many white pine plantations and natural stands now, and in the future, will require treatment. With these things in view this study was made to determine the relative time costs for pruning dead white pine limbs with various pruning tools now on the market and to determine the best of several methods for using them.

The desirability of such a study is immediately apparent to anyone who tries to choose from among the many models shown in any pruning tool catalog, but up to 1933, when Guillebaud (3) made a study of tools and methods in use in England, investigations of this problem were incidental to pruning studies. In 1936 Davis (2) made a more specialized study of tools and methods of use for western white pine (*Pinus monticola*, D. Don) and Bull (1) did the same for longleaf pine (*Pinus palustris*, Miller). The work of these authors gave results which are paralleled in this report. Guillebaud was the first author to report on the Tar-

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zan[2] method and his favorable conclusions were supported by Renshaw (5) who worked out and applied the same method in 1936.

Pruning on conifers, by these authors and others, has usually been on dead limbs because of added danger of decay from pruning live limbs.

A pruning study for hardwoods was made by Moss (4) but as with conifer pruning studies prior to Guillebaud, the emphasis is placed on questions of improving future lumber quality, rather than on determining the desirability of certain tools and methods of using them.

The Loch Raven Experiment

FOREST STAND

A 25-year-old northern white pine-yellow poplar (*Liriodendron tulipifera*, L.) plantation, set out in 1914 from 2-0 stock, on the shores of Loch Raven,[3] Md., was selected for the experiment. A thinning experiment also was under way in this stand. The trees were originally spaced 6x6 feet, but mortality has reduced this to a very irregular approximate 8 x 8 foot spacing. The yellow poplar constitutes about 15 per cent of the stand and was not used in the tool study as it self-prunes almost to the crown.

The actual pruning was done from March to May at the period of greatest cambial activity. Only healthy crop trees were used in this test, usually of the intermediate and codominant crown classes. These ranged from 30 to 45 feet in total height with dead limbs from 19 to 26 feet above the ground or a mean span of 22 feet to crown. D.b.h. varied from 5 to 11 inches. There was an average of 9 to 10 whorls of dead limbs from ground to crown with 6 to 10 limbs per whorl. This does not include one or two small twig whorls of the first few years' growth. Above 7 feet the whorls were 2 to 3 feet apart.

Figure 1 shows thinned and unthinned parts of the stand and the type of trees pruned.

EXPERIMENTAL DESIGN

Because of the large number of tools the study was divided into two parts. The preliminary test was a rough check to eliminate those tools which showed: (1) excessive tree damage, (2) high danger to worker, (3) comparatively high timecosts. It left the best tools to be compared under a more refined and detailed final test, which would also include consideration of the effects due to varying stand density and methods of tool use. Differences due to men were studied in both preliminary and final tests.

Answers were sought for the following questions:

(1) Are there significant differences[4] in timecosts between:

(a) Various pruning tools, regardless of workers or stand densities?

(b) Different workers, regardless of tools used or stand densities?

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[2]The essential feature of this method is to climb to the height to be pruned and then to work down. The pruner may force his way through or saw off a limb in each whorl to facilitate climbing. The 0 to 7 inch division can be done first and a short ladder used to climb into the whorls above this. These and other modifications have no appreciable effect on timecost. The term "Tarzan" was first applied by Dr. Bailey Sleeth of the Bureau of Plant Industry, who objected that "climb down" method was inaccurate since climbing up was equally important.

[3]One of Baltimore's water reservoirs.

[4]As used in this article the term "significance" indicates that a comparison of two or more objects, or groups of objects, shows differences which are a result of inherent qualities of the objects themselves and not a result of chance or errors arising from sampling. A "significant difference" between mean timecosts indicates that the tool or method with the lower mean timecost is definitely superior in rating.

(c) Different stand densities, regardless of workers or tools used?

(d) Various methods of using tools regardless of workers or stand densities?

(e) Different bole divisions as height increases above 7 feet from the ground, regardless of tools used, workers, or stand density?

(2) Are certain tools:

(a) More damaging to trees than others, regardless of worker?

(b) More dangerous for the worker, regardless of methods used?

TOOLS AND METHODS TESTED

The 21 tools shown in Figure 2 were selected from the catalogs of 6 manufacturers. Of these, numbers 3, 9, and 16 were modifications of numbers 1, 10, and 17, respectively. The changes consisted of shortening of blade or handle to allow freer movement between the closely set white pine limbs. The modified forms were used in the study.

Two types of ladders were included; a homemade 12 foot oak ladder without taper, and a 20 foot window cleaner's model in 5-foot sections.

The methods studied were as follows: (1) One-hand tools from ground and ladder. (2) Two-hand tools from ground only. (3) Pole tools, using 9, 14, and 19 foot pole lengths, from ground and ladder. 4. The new Tarzan method.

WORKERS

The men were chosen from some 200 C.C.C. enrollees of a veterans' camp. The work was explained to them and volunteers were called for. Five volunteered and were given a 5-day training period after which 3 were selected to do the actual pruning work throughout the entire study.

STAND DENSITIES

Three densities, in plots laid out for this study, were selected: the original stand (approximately 8 x 8 feet), 12 x 12 feet, and 17 x 17 feet spacings.

PRELIMINARY TEST

In this test tools and men and their relative timecosts, and tool damage to tree and danger to men, were the factors considered. All work was done in the original unthinned stand. No trial of methods was made in this and all work above 7 feet, except for pole tools, was done from a 10 foot ladder. Each of the 3 men used each tool on 3 trees, or 9 trees for every tool. The trees were selected mechanically in groups of 3 and these were assigned by lot to each man and tool. In order to insure that the tree groups would be relatively uniform only trees with 4 whorls from 0 to 7 feet were chosen. Timecost recording divisions were for 0 to 7 feet and the first 3 whorls above 7 feet. Only actual time for pruning the tree and setting and climbing the ladder was recorded. Trees with dead limbs over 2 inches in diameter were rejected, as it is generally agreed that limbs over this diameter tend to have heartwood and exposing this by pruning may increase the danger of disease infection; such trees would not be pruned under ordinary field conditions.

FINAL TEST

In this test the effects of stand densities and methods of using pruning tools were included with tools and men in determining relative timecosts. Tool damage to tree and danger to user were not considered. Four tools, the 3 handsaws and 1 polesaw which showed best results in the preliminary test, were used in the final test. The handsaws were used with the Tarzan method, and the most efficient one, the 5½ point California model, was used with the ladder method also. (The polesaw is in one sense a method, but for purposes of analyses, methods and tools were considered one class in this test.)

Fig. 1.—The Loch Raven plantations, site of the pruning and thinning experiments. Thinned plots in foreground and through center. Dense unthinned plots in right and left background.

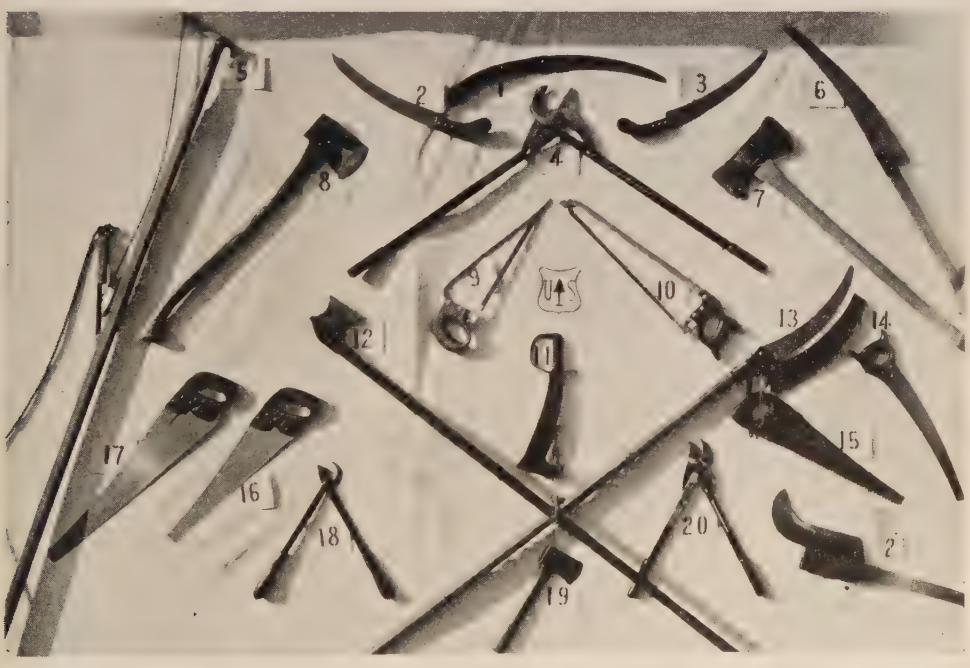

Fig. 2.—Tools used in the Loch Raven study. See Table 1 for names and descriptions.

Fifteen groups of 5 trees each were selected in each of the 3 densities. Three of these groups in each density were then drawn by lot for each tool, or tool and method, or 45 trees for each tool, and each man then drew 1 of these 3 groups, thus making a unit of 5 trees on which each man used each tool, or tool and method, in each density.

Timecost recording[5] for the 0 to 7 foot bole division was the same as in the preliminary test, but above 7 feet several changes were made, as all pruning was carried to the crown (approximately 22 feet). In the Tarzan method recording began when the worker left the ground and continued while he climbed, severed all limbs while descending from the crown to 7 feet, and returned to the ground. Recording for the ladder method was for time used in pruning that portion of the bole which could naturally be reached from a 10, 15, or 20 foot ladder length, and the time was subdivided to show actual pruning time and time used in erecting and climbing the ladder. Pole tool recording was for time used in pruning that bole division which could be reached with a 9, 14, or 19 foot pole length.

Results of Preliminary Test

Elimination of Tools for Damage to Tree and Danger or Excessive Fatigue to Worker

Tools 4, 5, 7, 11, 12, 18, 19, and 21 were eliminated for damage to tree, danger to worker, or excessive worker's fatigue. The ratings for each tool are given in Table 1. They are somewhat arbitrary and not based on complete data, as it was impossible to keep accurate time record and at the same time inspect, measure, and record all tree damage or to estimate and record all danger to worker. In general those tools rated "heavy" are worse than the records showed. The term "slight" indicates that damage to tree, danger to worker, or worker's fatigue had no appreciable effect on the operation. "Medium" indicates that these factors were distinctly noticeable and important, but not sufficiently damaging to warrant discarding the tool. "Heavy" indicates that bark gashes, spauls (bark stripping), or serrations, were a menace to the tree, or that there was a definite danger to the worker or that fatigue of worker was so great as to increase nonproductive rest time to more than 50 per cent of the total timecost. During the 5-day training period the poletool-ladder method and the homemade ladder were discarded because of high danger hazards to worker and unwieldiness.

Tools 1, 10, and 17 were discarded after the training period as being essentially the same as 3, 9, and 16, respectively. Tool 15, the gullet tooth saw, was eliminated in favor of 16, the carpenter type saw. Tool 2, the 7-point California saw, was discarded because of excessive gumming of the teeth.

The remaining tools, numbers 3, 6, 8, 9, 13, 14, 16, and 20 were used in analyzing the differences in mean timecosts.[6] Of these number 6, the heavy polesaw, was retained despite high damage rating in order to check thoroughly a tool which is in general use.

Timecosts

Tools.—Table 1 gives the timecosts of all tools used in the preliminary test. The differences between those statistically

[5]Timing by limb number or diameter or by set bole height was discarded as being too complicated and not representing actual field conditions.

[6]R. A. Fisher's shortcut method of analysis of variance was used. As illustrated in Geo. W. Snedecor's "Analysis of Variance" this made possible the arrangement and computation of variance between factors and differences of means of these factors' units with relatively short and simple mathematical labor and the results give an accurate picture of the significance of these values. "Mean timecosts" are hereafter referred to as "Timecosts."

TABLE 1

MEAN TIMECOSTS AND GENERAL RATINGS FOR ALL TOOLS IN PRELIMINARY TESTS

1	2		3	4	5	6
	Mean timecost in seconds			Ratings		
Total number and name	0 to 7 feet	3 whorls above 7 feet[1]	Remarks	Tree damage	Fatigue	Safety hazard
8 Pole, ax, used as mace	56		Most efficient timecost	Slight	Very slight	Slight
6 Polesaw, heavy, 18 inches, 5 point		156	7 to 14 feet best work. Difficult to guide above 14 feet	Very heavy	Very heavy	Heavy
12 Patented ax		162	Requires high skill	Very heavy	Heavy	Slight
11 Patented tool, edged	69		Requires skill.	Medium	Medium	Slight
		170	Inferior above 7 feet	Heavy	Heavy	Medium
19 Hand ax	70		Second in timecost.	Medium	Slight	Slight
		190	Requires high skill.	Heavy	Slight	Medium
7 Double-bitted ax	71		Dangerous to both man and tree	Very heavy	Medium	Medium
21 Brush hook	87		Requires skill	Heavy	Medium	Slight
3 California 5½ pt. saw	87	182	Best all 'round tool	Very slight	Slight	Slight
9 Butcher 7 pt. saw	103	198	Third best tool	Very slight	Slight	Slight
13 Pole saw, light, 14 inches, 7 pt.		209	Blade too light. "Shimmy"	Very heavy	Very heavy	Heavy
16 Carpenter 6 pt. saw	107	228	Second best tool	Very slight	Slight	Slight
14 Double edge 6-7 pt. saw	113	233	Upper edge snags	Medium	Slight	Slight
2 California 7 pt. saw	119	240	Gums with resin. Poor tool	Slight	Medium	Slight
15 Gullet-toothed 6 pt. saw	121	218	Shreds bark, makes rough cut	Medium	Slight	Slight
20 Double blade, point cut shears[2]	130		Best shear	Slight	Medium	Slight
18 Single blade, light shears	132		Too light, crushes bark.	Medium	Heavy	Slight
4 Double blade, heavy shears	141		Too heavy and awkward, leaves stubs	Heavy	Very heavy	Slight
5 Pole shears, single blade		195	Worst tool	Very heavy	Very heavy	Slight

[1]Hand tools above 7 feet used from 10 foot ladder.

[2]In defense of tool 20, and in view of results which we have obtained in numerous other forest pruning tests, we disagree with Mollenhauer's article, "Tools and Methods in an Experimental Pruning of White Pine," on the following grounds:

1. We believe there was insufficient sampling of trees in the testing of each implement. (Three different men pruned three trees each for each of the implements tested.)

2. Cuts were made only on dead limbs—a condition somewhat favorable to the saw, since pruning in live limbs greatly increases the tendency of the saw to strip the bark. Tool 20 is probably twice as fast as any pruning saw on live limbs.

3. The question of gumming of tools seems to have very little attention. We have found this to be a very definite factor in the work.

Inasmuch as we have made some study of this subject, we hope to present our own theories of forest pruning in a later issue of the JOURNAL.- J. G. GEDDES, *H. K. Porter, Inc.*

compared are given in columns 3 and 4, Table 2.

An analysis of the data from the 0 to 7 feet bole division of the preliminary test showed that of the 6 tools considered, the pole axe used as a mace had a low timecost of such significant difference from the other tools that it was accepted without further check. The No. 20 shears had a high timecost of such significant difference that it was discarded without further consideration. The double edged saw, number 14, was also rejected, because of the 4 remaining tools, all of which were handsaws, it had the highest timecost and damage ratings.

The data from the first 3 whorls above 7-foot bole division showed the same 3 handsaws leading, and these, along with the polesaw number 6, were chosen for the final test. This polesaw was given preference over the other tools despite its very poor tree damage and worker's safety record, because of its very favorable timecost and present general use for pruning work.

Men.—The data for the 0 to 7-foot bole division showed no differences in timecost that were significant, although the trend for some men to be faster than oth-

TABLE 2

MEAN TIMECOST DIFFERENCES BETWEEN TOOLS COMPARED

Tool number and name	Compared to tool number	Differences[1] between mean timecosts in seconds Preliminary test 0-7 feet	Preliminary test 3 whorls above 7 feet	Final test 0-7 feet	Final test 7 feet to crown
1	2	3	4	5	6
8 Pole ax-mace	3	**31**			
8	9	**47**			
8	16	**51**			
8	14	**57**			
8	20	**74**			
3 Saw, California	9	16	16	**8**	**92**
3 5½ point	16	**20**	**46**	**24**	**70**
3	14	**26**			
3	20	**43**			
3	6		26[2]		**238**
3	13		27		
3	3L				**131**
9 Saw, butcher	16	4	30	**16**	22[2]
9 7 point	14	10			
9	20	**27**			
9	13		11		
9	6		**42**[2]		**146**
9	3L				39
16 Saw, carpenter	14	6			
16 6 point	20	**23**			
16	13		19[2]		
16	6		**72**[2]		**168**
16	3L				**61**
14 Saw, double edge 6-7 pt.	20	1			
6 Pole saw, 5 point	13		**53**		

[1]Differences exceeding 18.23 in column 3; 36.68 in column 4; 7.66 in column 5; and 40.1 in column 6 were significant and are indicated by bold face type.

[2]The tools in column 1 had the lower timecosts when compared to the tools in column 2, except where the superscript 2 appears above the difference, in which case the tools in column 2 had a lower timecost than those in column 1.

ers was here indicated. In the 3 whorls above 7-foot bole division the timecost for Man I was significantly lower compared with Man III. Man II also had a lower timecost than Man III, but the difference was not significant. This seemed to indicate that along with differences of timecosts due to skill there were other differences due to working above ground and that this might be very important in selecting men for high pruning work.

Results of Final Test

Tools and methods of using them

Table 3 gives the timecosts of all tools used in the final test, and the differences between them in both the preliminary and final tests are shown in Table 2. Analysis of the data in the final test for the 0 to 7-foot bole division[7] showed the differences between timecosts of the 3 handsaws to be significant, and the California 5½-point saw as the most efficient of the three.

In the 7-foot to crown bole division the timecost differences between the California 5½-point saw (No. 3) and the other tools were highly significant, but those between the Carpenter and Butcher type saws (Nos. 16 and 9) used with the Tarzan method, and between the Butcher saw used with the Tarzan method and the California 5½-point saw used from a ladder (Nos. 9 and 3L) were not significant. In actual field work the differences in timecost between these poorer tools would be relatively unimportant, but the superiority of the California 5½-point model would be a decided factor in economical operation.

In Table 3, use of the California 5½-point saw with both methods shows the Tarzan method to be an easy leader over the hand tool-ladder method. The ease and security of this method are well illustrated by Figure 3. The benefits are most

Table 3

Mean timecosts and general ratings for all tools in final tests

1 Tool number and name	2 Mean timecost in seconds 0 to 7 ft.	7 ft. to crown	3 Remarks	4 Ratings Tree damage	Fatigue	Safety hazard
3 California 5½ pt. saw	63	330	Best all 'round tool	Very slight	Slight	Slight
16 Carpenter 6 pt. saw	87	400	Second best tool	Very slight	Slight	Slight
9 Butcher 7 pt. saw	71	422	Third best tool	Very slight	Slight	Slight
3L[1] California 5½ pt. saw, used with ladder		461		Very slight	Slight	Medium
6 Pole saw, heavy, 18 inches, 5 pt.		568	7 to 14 feet best work. Difficult to guide above 14 feet	Very heavy	Very heavy	Heavy

[1]All tools except 3L used with Tarzan method.

[7]This bole division gives the truest picture of the tool itself, as variations of timecost due to agility or fearlessness of the worker are at a minimum.

apparent above 15 feet, which is the approximate span limit from a 10-foot ladder. Table 4 shows the increasing loss of efficiency for the ladder method above this height, through more proportional nonwork time and the reduction of the working span as height increases insecurity and danger, and definitely proves that ladder work timecost increases with height from the ground due to this increasing proportion of nonwork time. This does not apply to the Tarzan method where the only increase in timecost is due to larger limbs at greater height.

MEN

The differences between the timecosts of Man I and III and Man II and III were highly significant in both bole divisions, thus further confirming the evidence of the preliminary test that selection of men is fully as important as choice of proper

Fig. 3.—(Left) California 5½ point saw used from 20-foot ladder. (Center) Heavy 18-inch, 17-gauge, 5 point curved saw on 19-foot pole. (Right) California 5½ point saw used with Tarzan method, pruner sitting on branches.

tools. This substantiates conclusions already reached by Davis. It is also interesting to note that the significance of differences between timecosts of men is porportionately greater in the 7-foot to crown bole division than in the 0 to 7-foot division. Table 4 further emphasizes this in the low percentage of nonproductive labor time shown by Man I,[8] which is a clear indication of greater individual ability or skill in the handling of the ladder. However, the use of only 3 men in the experiment is a defect, and the results should probably be considered as an indication rather than a proof.

STAND DENSITIES

The differences between the timecosts of the various stand densities were without significance in either bole division. A separate computation of the timecosts for the 10 and 15-foot ladder observations showed no significance in the total variance for stand densities in either bole division, but did show a barely significant difference between the timecosts of the 12x12-foot and 17x17-foot densities for the 10-foot ladder length observations.

We would expect any significant increase in timecost to appear in the 15-foot ladder observations, where the additional length noticeably increases unwieldiness, and in the extremes of density (the unthinned check plots and the 17x17-foot thinnings). Instead we find it in the relatively mobile and easily handled 10-foot ladder observations, and in the midway 12x12-foot thinnings. We therefore feel that this one barely significant difference may be disregarded, as due to some unexpected factors, such as exceptionally large limbs or an indisposed worker, which affected the particular group of trees which fell to one of the 10-foot bole division and 12x12-foot density units.[9]

CONCLUSIONS

MACE-CLUB

The pole ax used as a mace (No. 8) is unquestionably the most efficient tool for the 0 to 7-foot bole division. The only damage arises from the formation of stub holes when the limbs are knocked off. These occur in about 50 per cent of the operations and the "collar," characteristic of northern white pine, is broken in about 25 per cent. Just how this affects future lumber quality is not known at this time. Some believe it results in formation of pitchpockets and entrance of decay organisms. The author believes that such pitchpockets will not affect the lumber beyond the annual ring of the pruning year and that deposition of pitch in the hole will be an effective insurance against decay.

EDGED TOOLS

The edged tools in general require a higher degree of skill than is usually available for pruning work. If men can

TABLE 4

PERCENTAGE OF TOTAL PRUNING TIME USED IN ERECTING AND CLIMBING A SECTIONAL LADDER

Man	10-foot ladder setup (Average No. of whorls pruned, 3.6)	15-foot ladder setup (Average No. of whorls pruned, 2.0)	20-foot ladder setup (Average No. of whorls pruned, 1.5)
	Per cent	*Per cent*	*Per cent*
I	13.6	33.3	42.2
II	12.6	41.6	
III	16.5	38.6	
Percentage of total time for all men	14.0	38.0	42.2

[8]This man had been a painter.

[9]This separate analysis reduced the total density observations from 75 to 15 for each density, thereby greatly increasing the possibility of error from insufficient sampling.

be trained to cut on the upstroke much of the damage may be avoided. Use from a ladder greatly increases the worker's hazard and 2-hand edged tools such as the double-bitted ax should never be used above the ground.

The No. 12 ax is unsuited for work on dead limbs, particularly large ones. Where they exceed ½-inch diameter it is necessary to jerk the tool, and this often results in heavy tree damage. Considerable skill is required for proper operation and a slight slip can easily slice off half a square foot of bark. Used on live limbs under ½-inch diameter, or on species with heavy bark, it may be a good tool.

(By oversight the machete was not included in the study.)

SAWS

Handsaws as a class are the best tools. They are easier to use, do less damage to the tree, and are the safest of all.

Freak models, such as deep gulleted teeth (No. 15), are usually inferior to standard types. Double-edged saws are seldom used on both sides and the unused edge is constantly snagging. Pull stroke models are preferable for most pruning as the operation is usually above the waist, so that a push stroke loses the benefit of body weight and relies almost entirely on muscular exertion.

The California saw with 5½ points (No. 3), long needle teeth, and pull stroke was found to be the best all 'round tool for this type of pruning, as the slim blade and pistol grip make it ideal for working between the close-set limbs of white pine. The Butcher and Carpenter types (Nos. 9 and 16) are good tools, but inferior to the California type.

In general, pruning saws for work above 7 feet should be 16 inches or under in blade length and with the blade as narrow and tapering as is practical with rigidity.

The heavy 17-gauge, 5-point, 18-inch curved, pullcut polesaw (No. 6) is probably the best tool of this type, but the type is none too good. Lighter models "shimmy" when used with poles longer than 9 feet. Poles over 9 feet bend under the pressure necessary to operate them, as can be seen in Figure 3. Use of more rigid, but lighter, aluminum poles might overcome this. Setting the saw at a greater than 15-degree angle on the pole causes it to "hang" in the limb. Falling sawdust is a constant menace to vision and the use of goggles slows up the work. Undercutting the limb to prevent spauling is practically impossible above 15 feet, as the tool is too cumbersome to work in the necessary position. The method, advocated by Simmons, (6) of cutting until the limb bends, stopping as it breaks and resuming and finishing the cut while the limb hangs by the stub requires a knack and is not always effective. Above 15 feet the cut becomes almost vertical and this further disturbs the control of the "breaking," while the longer pole makes quick and accurate operation of the tool more difficult.

The values for this tool given in Table 3 are for the entire bole division from 7 feet to crown, but since this tool gives best results from 7 to 12-14 feet (the 9-foot pole length), which corresponds to the first 3 whorls above 7 feet of the preliminary test, the data for this tool in both tests were further analyzed. Another variance table was computed to determine whether there was a significant difference between the timecosts of the two tests, as the preliminary test removed 3 whorls and the final test only 2.9 whorls; none was found. A similar comparison of the preliminary test figures for tool No. 3, the 5½-point California saw, showed these preliminary test results to be reasonably accurate. We therefore feel justified in stating that even in its most efficient field the polesaw shows no superiority in timecost over the California saw, and in the higher bole divisions it is decidedly inferior, while high damage and danger rat-

ings further disqualify it. Unanimous opinion after the test classed it, both figuratively and literally, as "a pain in the neck." See Figure 3.

SHEARS

Of the shears only No. 20 does clean work, and even with this tool frequent retrimming is necessary, while the tendency to reach around the bole often results in leaving an edged stub. Timecost is high. Used on live limbs this tool's comparative freedom from resin "gumming" may improve the relative time cost.

Present pole model shears are totally unsuitable. The work is almost 100 per cent bad, with stubs ½ inch and over. Timecost and excessive worker's fatgiue make this the worst tool of all those tested.

METHODS

The Tarzan method is superior to ladder pruning in this type of stand, especially above 15 feet, as there is no increase in pruning time regardless of height; except for increase in limb diameters. Ease and safety of the method are shown in Figure 3.

Ladder lengths longer than 10-12 feet add greatly to insecurity and this undoubtedly increases danger and inefficiency. The hazard and difficulty of high ladder operations are well illustrated by Figure 3. Besides this the proportion of total time used in erecting and climbing the ladder increases rapidly with height. These points are well brought out in Table 4.

STAND DENSITY

Density, or spacing, has little effect on timecost in this type of stand and may be safely disregarded with the possible exception of ladder pruning above 20 feet in stands where the limbs are closely interlaced. Ladder lengths of 20 feet or less are not difficult to maneuver in if the ground is reasonably clear.

MEN

Differences in men: aptitude, alertness, psychology, weight, age, length of arm, and other personal factors, may be highly important in the selection of pruners, and such selection may be as important in the timecost of a pruning operation as the choice of proper tools. Our experience indicates that the best pruners appear to be under 160 pounds in weight, under 40 years of age, of slender build, and unafraid of working above ground. A more detailed study of men, to determine which qualities are most important, seems desirable.

GENERAL

For efficiency, keep tools sharp, and clean them at frequent intervals with kerosene on a rag.

For safety of the worker and protection of the tree from bark injury, provide rubber-soled shoes to workers, and rubber or burlap-wrapped Y brackets for the ladder tops.

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COMMENTS ON THE GENERAL APPLICATION OF GEHRHARDT'S FORMULA FOR APPROACH TOWARD NORMALITY

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The impetus which has been given to forest surveys, local and national, during recent years has brought into the limelight many mensuration problems connected with the timber inventory. Of these problems, one, in particular, has long been the concern of those interested in forest measurement: how should normal-yield tables be used to predict the growth of abnormally stocked stands? It has been recognized that understocked stands, through relatively faster growth, tend to approach the fully stocked, or normal, condition; but the dearth of information on the magnitude of this approach has led to much uncertainty in the application of normal-yield tables to the run of growth problems. This paper discusses a method widely employed in Europe for allowing for approach toward normality—showing that this method may well be applicable to American conditions, and paving the way toward greater usefulness of our normal-yield tables.

NORMAL-YIELD tables unquestionably offer the most simple and straightforward means of calculating growth for short periods in the future. In one respect, however, this calculation has always been open to criticism: there is no standard, well-tried method of allowing for the fact that the growth per cent of understocked stands is higher than the normal per cent—that is, that understocked stands approach normality.

The difficulty of solving the problem of approach toward normality has led to the practice of disregarding this factor altogether in the use of normal-yield tables, and of assuming—in spite of the fact that all evidence points to the contrary—that growth per cent is not affected by stand density, or that growth of an understocked stand g is related to the normal-yield-table growth G as in the equation

$$g=dG,$$

where d=density of the understocked stand related to the normal.

In a recent article[1] Gevorkiantz presented a suggestion for allowing for approach toward normality by use of a formula widely employed in Europe and devised by Gehrhardt. This formula applies a simple correction to the expression above, and takes the general form.

$$g=dG\ (1+K-Kd).$$

The formula[2] is designed to express approach during a 10-year period. K is a constant for any given timber type, and ranges approximately from 0.6 to 1.1, depending upon the tolerance of the species in question. It is determined from the relation

$$K=\frac{p-P}{P\ (1-d)},$$

where p and P are growth per cents for the next 10 years in understocked and normal stands, respectively. Gevorkiantz showed that gross growth in basal area of understocked stands of northern hardwoods can be expressed by Gehrhardt's formula, using a constant K of 1.0.

Before Gehrhardt's formula can be applied with confidence to the general run of growth calculations, however, it is necessary to demonstrate its applicability under various conditions, for example:

[1]Gevorkiantz, S. R. The approach of northern hardwood stands to normality. Jour. For. 35:487-489. 1937.

[2]If retrogression, rather than growth, is taking place, as is often the case with respect to basal area of overmature timber, an equivalent allowance for retrogression of understocked stands may be made by use of the expression, $g=dG\ (1-K+Kd)$, where G is a minus quantity.

1. Does the formula apply to species and timber types other than the northern hardwoods, and if so, what are the correct constants to use?

2. Is the formula suited to growth calculations in other units than basal area, such as board feet or cords?

3. What is the effect upon the usefulness of the formula if the yield table employed does not represent true normality, but is based upon stands somewhat under- or overstocked?

4. Can the constant K determined from an analysis of gross growth per cents (no deduction made for mortality) be used in conjunction with a yield table, where growth is net?

This paper presents the results of a few studies which have been made in an effort to answer these questions.

Gehrhardt's Formula Applied to Various Species

A test was made of the applicability of Gehrhardt's formula to various species, based upon sample plots taken in the Forest Survey throughout the Lake States in stands undisturbed by cutting or fire, and representing different degrees of density. Plots of each species were sorted into three density classes, based upon the unit of measure to be examined, and the gross growth for the next 10 years computed by means of increment cores taken on the plots. Gehrhardt's constant was then calculated for each group of understocked plots, related to the group of good density, which was considered normal. The types investigated were jack pine, an intolerant species, oak, representing about intermediate tolerance, and cedar, generally conceded to be very tolerant. Results obtained from an analysis of gross growth in basal area[3] of the jack-pine plots are given in Table 1.

Gehrhardt's constant was similarly computed for oak stands and for cedar. For oak, the constant was found to be 0.8, and for cedar 1.0.

It appears that at least for the timber types and unit of measure examined, Gehrhardt's formula offers a sound basis for allowing for the approach of understocked stands toward normality, and that the constant K to be substituted in the general formula runs about as follows, depending upon the tolerance of the species:

Intolerant species: 0.6—0.7.
Intermediate: 0.8—0.9.
Tolerant species: 1.0—1.1.

This suggests that where an actual determination of the Gehrhardt constant cannot be made, the formula can still be employed, using a value of K based upon what is known of the tolerance of the species in question. The higher Gehrhardt constants, associated with tolerant

Table 1

Calculation of Gehrhardt's constant K for gross growth in basal area of jack-pine stands

Type of stand	Average basal area per acre	Density related to normal	10-year gross growth in basal area	10-year growth per cent	Gehrhardt's constant K
	Sq.ft.		*Sq. ft.*		
Cordwood	165.7	1.00	70.5	42.5	
	134.0	0.81	63.4	47.3	0.59
	110.3	0.67	56.2	51.0	0.61
Sawtimber	160.5	1.00	39.0	24.3	
	137.2	0.85	36.3	26.5	0.60
	103.3	0.64	29.9	28.9	0.53
All					0.6

[3]Basal area of all trees in the stand 1 inch or larger d.b.h.

species, represent a more rapid approach toward normality, which is consistent with the fact that tolerant species are physiologically capable of a greater growth response to understocking.

Gehrhardt's Formula Applied to Various Units of Volume

Gehrhardt's formula was developed from studies of growth in total cubic-foot volume of stem and limbs down to a very small diameter, and has been checked closely by the use of basal area of all trees 1 inch and larger in diameter as a unit of measure. Both these units are what might be called "natural," as opposed to "artificial" units like board feet or cords, which employ minimum defect allowances, minimum diameters at breast height and top, and other merchantability standards. An outstanding characteristic of growth in a unit of volume which employs merchantability standards of size is the fact that it is apt to be made up at least partly of volumes of small trees which were unmerchantable at the beginning of the period under consideration, but which attained merchantable size during the period and thus increased their volume from nothing to a considerable amount. Will Gehrhardt's formula express the approach of understocked stands toward normality, in terms of such "artificial" units of volume?

Stands of northern hardwoods were first examined. Gross growth in board feet[4] was computed for several densities and types of stands, and a constant of 1.0 obtained. This is the same as that derived for growth in basal area. Calculation of the board-foot constant was also made for oak and jack pine; the constants were found to be 0.6 and 0.8 respectively, or the same as those found by use of basal area.

The calculation of Gehrhardt's constant was next made, using cubic-foot and cord volumes.[5] For all species examined, the constant was found to remain practically unchanged, regardless of the unit of volume used. In two instances the computed constant was found to be somewhat higher than expected. This was apparently due to the presence in the stands of an unusually large number of trees just below merchantable size, which grew into the merchantable stand during the 10-year period and thus raised the growth per cent disproportionately. The determination of the cubic-foot constant for jack pine is given in Table 2.

As far as can be determined from the

Table 2

CALCULATION OF GEHRHARDT'S CONSTANT K FOR GROSS GROWTH IN CUBIC FEET OF JACK-PINE STANDS

Type of stand	Average volume per acre	Density related to normal	10-year gross growth in volume	10-year growth per cent	Gehrhardt's constant K
	Cu. ft.		*Cu. ft.*		
Cordwood	1,470	1.00	1,275	86.7	
	1,226	0.83	1,176	95.9	0.62
	1,110	0.76	1,108	99.8	0.63
Sawtimber	2,411	1.00	882	36.6	
	2,276	0.94	863	37.9	0.59
	1,756	0.73	740	42.1	0.56
All					0.6

[4]Scribner scale of sound trees 9 inches and larger d.b.h., to a variable top as actually utilized in woods operations. Trees were assigned no volume unless they fulfilled certain minimum requirements as to number, size, and quality of logs.

[5]Cubic feet of sound trees 5 inches and larger d.b.h., to a top diameter of 4 inches i.b. Cord volume includes this same material, piled with the bark on.

data studied, then, Gehrhardt's formula is applicable to growth calculations in various units of volume, and the unit employed apparently does not appreciably affect Gehrhardt's constant, provided that the volume of trees growing over the merchantability limit is not greatly abnormal.

Gehrhardt's Formula Applied to Non-Normal Yields

In the Lake States region yield tables are in use which are based, not upon normal stands, but upon the average of well stocked stands, which run somewhat below normal in stocking. It is important to know whether Gehrhardt's formula can properly be used in connection with these yield tables, or with any yield table which does not represent the true normal.

Referring to Table 1, what would be the effect upon Gehrhardt's constant if medium density instead of good, or normal, density were used as a system of reference? Table 3 illustrates this effect.

The use of an understocked system of reference is seen to lower the Gehrhardt constant. This does not mean that approach toward the understocked system is less rapid, but simply that part of the approach is already accounted for in the preliminary expression

$$g=dG,$$

since growth per cent of the understocked system is high and the apparent density of the stand under consideration also high.

The relation between the Gehrhardt constant k applicable to an abnormally stocked system of reference and the constant K for the fully stocked, or normal, system can be expressed in the form

$$k=\frac{KS}{1+K-KS},$$

where S is the density of the abnormally stocked system at any point, related to the normal. The formula, of course, applies to any two systems, or trends of stand development, whether normal or not. It indicates that Gehrhardt's formula is applicable to any type of yield table, provided the proper constant is used.[6] But it indicates also that the standard constants—0.6 to 1.1, depending upon tolerance—can be employed only in connection with an approximately normal-yield table. Variation of Gehrhardt's constant as determined from the formula for k is illustrated in Table 4. $S=1.0$ is taken to be the point of true normality.

Thus the determination of a low constant for a given species may mean either that the species is intolerant and will approach normality slowly, or that the system of reference used is understocked, or both.

Table 3

CALCULATION OF GEHRHARDT'S CONSTANT K FOR JACK PINE, USING MEDIUM DENSITY AS A SYSTEM OF REFERENCE

Type of stand	Average basal area per acre	Density related to medium stocking	10-year gross growth in basal area	10-year growth per cent	Gehrhardt's constant K
	Sq. ft.		*Sq. ft.*		
Cordwood	165.7	1.24	70.5	42.5	0.42
	134.0	1.00	63.4	47.3	
	110.3	0.82	56.2	51.0	0.43
Sawtimber	160.5	1.17	39.0	24.3	0.49
	137.2	1.00	36.3	26.5	
	103.3	0.75	29.9	28.9	0.36
All					0.4

[6] If the abnormally stocked table, itself, represents an approach toward normality, the Gehrhardt constant, theoretically, varies slightly with age, since S is changing.

Gehrhardt's Formula Applied to Net Growth

The Gehrhardt constant K has been derived successfully by use of gross-growth per cents. But before the Gehrhardt formula can be applied to yield tables, where growth per cents are net, the effect of mortality upon the formula must be determined. In order for any constant derived from gross growth to be applicable to net growth, it must equal

$$K=\frac{p-P}{P(1-d)}=\frac{p_n-P_n}{P_n(1-d)},$$

where the subscript $_n$ designates net growth.

For this condition to be fulfilled, $\frac{p_n}{p}$ must equal $\frac{P_n}{P}$, that is to say, mortality must bear a constant percentage relation to growth per cent and to the growth itself. Obviously this is the case where the assumption is made that

$$g=dG.$$

Since it is this assumption to which the Gehrhardt correction is applied, it may be concluded that the Gehrhardt formula, for which the constant has been derived from gross-growth per cents, is applicable to the net growth of a yield table.

Table 4

Values of k for various combinations of K and S

S	K					
	Intolerant		Intermediate		Tolerant	
	0.6	0.7	0.8	0.9	1.0	1.1
1.2	0.82	0.98	1.14	1.32	1.50	1.69
1.1	0.70	0.83	0.96	1.09	1.22	1.36
1.0	0.60	0.70	0.80	0.90	1.00	1.10
0.9	0.51	0.59	0.67	0.74	0.82	0.89
0.8	0.43	0.49	0.55	0.61	0.67	0.72
0.7	0.36	0.40	0.45	0.50	0.54	0.58

An Example of the Use of Gehrhardt's Formula

As an example of the use of the Gerhardt formula with a yield table in predicting growth, take a stand of 60-year-old timber for which a 20-year growth prediction is required. Volumes per acre in board feet shown by the yield table are as follows:

At 60 years: 5,000 board feet.
At 70 years: 6,500 board feet.
At 80 years: 7,500 board feet.

The stand in question has a volume per acre of 3,000 board feet, and is thus 60 per cent stocked.

The Gehrhardt constant for the species has not been determined. The tolerance of the species is about average, corresponding to the standard constant 0.8. However, since the yield table is known to be based upon overstocked stands, the constant 0.9 is tentatively adopted from Table 4.

For the next decade (60 to 70 years) growth will equal

$g=dG\ (1.9-0.9\ d)$
$=0.6\times1,500\ (1.9-0.9\times0.6)$
$=1,224$ board feet per acre.

Volume per acre 10 years hence will thus be 3,000+1,224, or 4,224 board feet, making the stand 65 per cent stocked at that time.

Growth during the second decade (70 to 80 years) will be

$g=0.65\times1,000\ (1.9-0.9\times0.65)$
$=855$ board feet,

and volume 20 years hence, 5,079 board feet per acre, making the density 68 per cent.

Thus, by use of Gehrhardt's formula, the stand is predicted to grow 2,079 board feet per acre during the next 20 years, and to increase its stocking from 60 to 68 per cent during that time.

BRIEFER ARTICLES AND NOTES

A Note on the Calibration of Duff Hygrometers

The duff hygrometer, used widely to measure moisture content of leaves, needles, and cellulose, both in fire control and in industry, requires careful calibration if readings are to be accurate. This is emphasized in a recent paper by Kachin and Gisborne.[1] This paper describes a method of calibration in which the duff hygrometer spikes are inserted in cylindrical cans containing duff of various moisture contents. The readings of a hygrometer are made on an arbitrary linear scale in the instrument and are plotted as a function of the moisture content of the duff in the various cans. A smooth curve is then drawn through the resulting points and from this curve a new scale may be drawn on the hygrometer dial which reads directly in moisture content.

The writer has used the method of calibration described by Kachin and Gisborne, but finds that much more accurate results were obtained by altering the procedure for obtaining the oven dry weight of the duff in the calibration cans. The simplest method which Kachin and Gisborne propose for determining this dry weight is to place the cans of duff in an oven and gradually raise their temperature to 100° C. The cans are then weighed and the oven dry weight of the duff in any given can is assumed to be the difference between the total weight of the can and duff and the weight of the can alone (previously determined). However, a different weight is obtained when a can is weighed hot than when weighed cold. Calibration cans used at the Appalachian Forest Experiment Station have a volume of 4.9 liters and weigh about 1.4 grams more after cooling to a room temperature of 23° C. than at a temperatuer of 105° C. when just removed from the oven. Although this difference in weight has been considered by some to be due to the gradual absorption of water by the duff, actually it is due to a change in density of the air in the hot and cold cans.

Since the density of a gas at constant pressure is inversely proportional to its absolute temperature, it is possible to predict the difference in weight between the hot and cold cans. If D_1 and D_2 are the densities of air at absolute temperatures T_1 and T_2 then (Equation 1)

$$\frac{D_2}{D_1} = \frac{T_1}{T_2}$$

If the room temperature, T_1, is 23° C. and the oven temperature, T_2, is 105° C., the density ratio is

$$\frac{D_2}{D_1} = \frac{273 + 23}{273 + 105} = \frac{296}{378} = 0.78$$

The weight of dry air at a temperature of 23° C. is about 1.2 grams per liter, and since the duff cans have a capacity of 4.9 liters, they will contain about 5.9 grams of air at this temperature. At a temperature of 105° C., they will contain 5.9 (0.78) or 4.6 grams, hence the cans will be about 1.3 grams heavier at the lower temperature. Table 1 gives the weight of six different 4.9 liter con-

[1] Kachin, T., and H. T. Gisborne. The technique of calibrating duff hygrometers. Jour. For. 35:736-743. 1937.

tainers when weighed at a temperature of 105° C. (when just removed from the oven) and at a room temperature of 23° C. The difference in weights agrees quite well with the theoretical value given by Equation 1.

From the results given in Table 1, it appears that if the duff cans are weighed hot, an appreciable error is introduced in the construction of the hygrometer scale, which makes the instrument read too high. For a 4.9 liter can containing 100 grams of duff, this error will be about 1.4 per cent, which is about three times as great as the error expected in the hygrometer at low moisture contents.

To obtain the correct dry weight of the duff, the cans should be allowed to cool to room temperature before weighing, or if they are weighed hot, the correction factor given by Equation 1 should be applied. If the first method is used, about 1.4 grams of cold air will force its way into the calibration tube carrying a certain amount of water vapor, which will be absorbed by the duff. However, even at a room temperature of 23° C. and a relative humidity of 100 per cent, the 1.4 grams of air which enters the tube can carry only .03 grams of water vapor. This would have a negligible effect on the duff moisture.

In computing the volume of the calibration tubes, it is permissible to neglect the volume actually occupied by the duff material. If a small sample of wood is compressed in an ordinary hand vise so that air spaces in the wood are made quite small, the sample will sink when placed in a beaker of water. This shows that wood (and presumably duff and leaves) in a semi-solid form has a density greater than water and hence 100 grams of wood substance occupy an effective volume of less than 0.1 liter or 100 cc. If for any reason it is necessary to pack a large quantity of duff or litter into a calibration tube, it might be necessary to allow for its effective volume, but no more than 100 cc. should be subtracted for each 100 grams of duff substance.

Table 1

A COMPARISON BETWEEN THE HOT AND COLD WEIGHTS OF SIX DIFFERENT DUFF HYGROMETER CALIBRATION TUBES

Tube	Weight at 105°C.	Weight at 23°C.	Difference
	grams	*grams*	*grams*
1	1030.8	1032.2	1.4
2	1055.3	1056.8	1.5
3	1029.4	1030.9	1.5
4	1016.6	1018.1	1.5
5	1042.1	1043.4	1.3
6	1040.9	1042.4	1.5

George M. Byram,
Appalachian Forest Experiment Station.

A Device for Measuring Sample Plot Radius

The work of measuring the radius of circular plots used in estimating timber becomes laborious if conscientiously done. Small box pocket steel tapes have been used for this purpose and are accurate provided slope of the tape is taken into consideration, but each tree which is checked to determine whether it is in the plot or out of it requires a trip from the plot center to the tree or vice versa and the rewinding of the tape. Some device producing reliable results with less labor and time has been desired by many cruisers. It occurred to E. E. Smith, who was then working on the Grand Lake Purchase Unit in Maine, that stadia could be used to measure plot radius effectively. This suggestion seemed to have a great deal of merit since stadia has been used in cadastral and other survey work with highly satisfactory results.

The problem was taken up with an instrument company, and one of their expedition transits was found to be fitted with a telescope that was internal focusing, astronomical, and only 6¾″ long and 1⅜″ in diameter at its largest point

This telescope without level tube or horizontal axis was fitted with stadia hairs at an interval of 1 to 66. The internal focusing telescope has no f + c constant. The telescope and case are illustrated in Figure 1. A stadia rod was designed for each plot size. The rod for a one-tenth acre plot is also shown in Figure 1. "Rods" made of heavy white drawing paper were easiest to make and carry, and although less durable than a painted wood rod are also much cheaper to replace if damaged or lost.

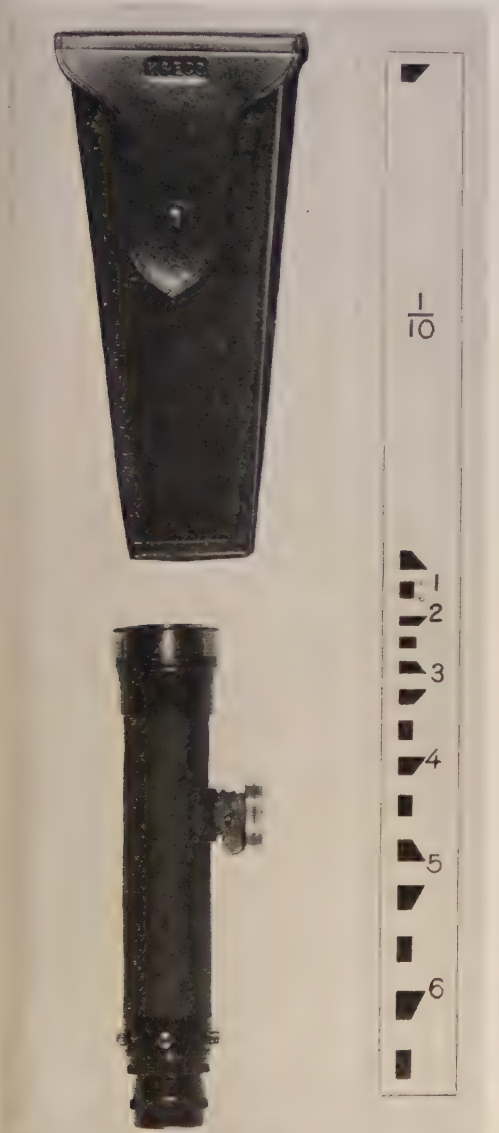


Fig. 1.—Telescope, case, and stadia rod for a one-tenth acre plot, for use in measuring sample plot radius in timber estimating.

The rod is made up with two marks indicating the proper intercept for a given plot radius for a level observation. The additional marks correspond to the proper intercept for the same plot radius at different vertical angles expressed in topographic degrees. The observer does not determine what distance a tree is from the plot center, but only whether the tree is in or out of the plot. The greatest handicap in using the telescope is the lack of a steady mount for it, but by holding it against a tree carefully a fairly steady "shot" may be taken. The closer a tree is to the edge of the plot the greater is the need for close observation and a steady telescope. For inclined "shots" a reading is taken with an abney level first and the corresponding graduation observed with relation to the intercept.

Experience with the instrument has been somewhat limited, but in a number of cases the telescope checked against the tape enabled the observer to call trees "out" or "in" correctly within less than a foot and in general within less than half a foot. Where a two-man party is used it is faster than a tape and much less tiring to use. It is difficult to use in heavy brush but a tape is also tedious and slow under that condition. It has been quite surprising how many times in brushy terrain it was possible to take a reliable stadia shot.

Considerable thought has been given to the possibility of combining this telescope with an abney level arc and bubble arm so as to eliminate one instrument from the equipment to be carried. The only practical plan seems to be to clamp the arc to the side of the telescope and to make no attempt to bring the bubble next

to the line of sight, as in the abney level sighting tube, but to fit the opposite side of the telescope with a pair of points which could be pressed into the side of a tree while sighting so that the instrument is held rigidly in the same position while the level bubble is centered and the vertical angle read. So far this has not yet been tried out.

The instrument costs about $98, including the case. This price is high for such an instrument, but it is believed that it is worth it if much circular plot work is to be done. The instrument is by no means perfect but it does seem effective. It is the purpose of this note to make available to others, who may have considered this tedious problem, our experience with this trial instrument.

KARL D. HENZE,
U. S. Forest Service.

RETURN FROM A WOODLOT IN EAST CENTRAL MINNESOTA

Incidental to some blister rust control work, Arthur F. Oppel, a member of the Minnesota Forest Service, visited the farm of C. E. Johnson, located about five miles west of Rush City, Isanti County, in the winter of 1919.

The major object of this visit was to convince the local residents that it was worthwhile to protect the second growth white pine on their lands against blister rust infection. When Mr. Johnson was approached he was not interested because he could see no income from his woodlot and had planned to clear the land for agriculture.

Mr. Oppel finally convinced Mr. Johnson that the woodlot was worth saving, by pointing out some of the more apparent values of the woodlot, such as providing firewood, fence posts, wagon tongues, and even lumber. He explained how the cutting of some of the larger trees would benefit the stand by providing more growing space for the young trees and at the same time give Mr. Johnson an immediate income from the sale of forest products.

Some of the trees were marked for cutting during the winter but the important point was that the woodlot was saved.

Years passed. Again in 1935 a crew working on blister rust control appeared on Johnson's farm. This time no argument was needed to prove the value of the woodlot to Mr. Johnson. In fact, he considered the woodlot the most valuable part of his farm. During the preceding winter he had harvested about half of the timber from 2.1 acres of the woodlot, which yielded a total of 55,327 board feet. Of this amount he sold 47,227 feet, mill scale, to a portable saw mill west of Pine City at $16.50 per M., delivered on a landing in the woods. An additional 4,290 feet, mill scale, was sold at $25.50, which included $4.50 per M. for sawing. Mr. Johnson still has 2,350 feet for his own use which he values at $20 per M. The total return to the owner on the 2.1 acre plot amounted to $943.69 for the saw logs only. In addition, several loads of slashing were sold for firewood at one dollar per load. This brought the total return to $955.69, or $477.84 per acre. A check of the area showed the average age of the trees cut to be 51 years, making the yearly return per acre $9.37. In the words of the owner this was a far better return from land considered worthless for agriculture than he could get from his potato crop.

Within another ten years another cut can be made that will yield at least as much lumber as was cut in 1935. The stand is now reproducing, 378 trees per acre already having become established.

H. OSTERGAARD,
Minnesota Forest Service.

Cattle Show Preference for Certain Grasses Experiments Reveal

Cattle, like men, show a pronounced preference for some articles on the menu, while other items are simply sniffed at or ignored completely. Details of preferences shown by grazing animals on the range are reported by the Southwestern Forest and Range Experiment Station near Tucson, Arizona, where during the growing seasons of 1934-35-36 careful observations were made throughout the day, often for as long as 14 to 16 hours at a time.

Range plants were placed in four classifications: Plants definitely selected, plants eaten without any definite choice, plants usually omitted, and plants omitted altogether. Following are some of the results of observations concerning grazing habits of range cattle:

During the summer of 1934 black grama, slender grama, cotton grass, tanglehead, porters muhlengergia and wild millet were definitely selected. Curley mesquite, large three-awn sideoats grama, California three-awn, and Texas timothy were definitely selected early in the summer, but during the latter part fell into the second group. Rothrocks, sprucetop, and hairy gramas and panic grass fell into the second group or among grasses eaten without any choice throughout the summer. Six-weeks needlegrass and six-weeks gramas were grazed generally along with other grasses early in the summer and then not at all during the latter part. Most of the weeds fell into the groups usually omitted, or omitted altogether.

Cattle did not show any preferences for the important shrubs. Calliandra, baccaris, and krameria were grazed indiscriminately along with the grasses. Other shrubs, such as cholla, mesquite, mormon tea, saltbrush, hackberry, and burroweed were grazed sparingly.

During 1935 and 1936 nearly all the important grasses were grazed largely without selection throughout the summer. Three exceptions were noted: black and slender gramas and cottongrass — they were selected for a short period early in the summer of 1936. The animals retained their aversion to weeds throughout the summer for both years. Shrubs varied slightly with calliandra, mesquite and baccaris being grazed without choice along with the grasses in 1935 and lightly to not at all in 1936.

For the winter of 1934 and spring of 1935 most of the important grasses were grazed indiscriminately.

Perhaps the most significant things to come out of the study to date are the much more general use of six-weeks gramas and needlegrasses during the summer and the rather consistent use of browse, such as mesquite, calliandra, krameria, and catclaw, along with the grasses throughout the summer growing season.

We Are Cited as a Good Example

Dr. R. Maclagan Gorrie of the Indian Forest Service, who visited the U. S. recently, made the following statement in a radio address April 2, 1937 at Delhi:

"Recent developments in the United States have focussed attention upon the part which forestry can play in the better management of farm lands. A great many trained foresters are now employed by that government to help the farmers to grow their own plantations of trees.

"The policy there is to plan each farm community so as to make the best use of all land and this naturally includes the growing of trees in shelter belts, which will reduce the drying effect of wind on farm crops; and the planting of all ground which is too steep or too poor for crops or grazing. A privately owned farm plantation is there called a 'woodlot' and happy is the man who has one on his farm.

"The forester has become a necessary person in every American farming community and it is to be hoped that he will also find a place in the Punjab village, because afforestation of a part of the uncultivated land would solve many of the Zamindar's present problems."—Afforestation for Villages in the Punjab. Forest Dept., Punjab, India.

Fire Damage to Old Stands in Northern Tennessee

A corporation holding a large acreage of mixed hardwoods and pine in the Cumberland Mountains northwest of Norris Lake in Tennessee made a deduction on their 1935 income tax return for depletion due to loss of mature timber because of forest fires. On 2,135 acres burned over they estimated the loss at approximately 61 cents per acre and so reported it on their return.

About two years after the return was made the Bureau of Internal Revenue questioned the reported loss, their valuation engineer contending that mature trees do not sustain a preceptible loss by ground fires in the mountains of the southern hardwood region.

There was no difference of opinion on damage to young growth. This question was not involved. According to a statement from the Bureau, timberland owners must set a valuation on their land and on their timber as of March 1, 1913, the date the income tax laws became operative, if the property was acquired prior thereto. If the timberland has been purchased since March 1, 1913, the figures must be set up similarly on land and timber at the date of purchase. From this valuation of timber and the estimated footage a price per M is set to be used for the purpose of depletion as the timber is manufactured, otherwise disposed of or destroyed. When possible to employ this depletion taxable profits will be reduced and since the federal tax was 14½ per cent in 1935 timberland owners could effect quite a saving by permitted usage of depletion allowances.

Not a large sum was involved but the company wished to sustain their claim because loss of the point under contention might set a precedent. They felt the Bureau of Internal Revenue was mistaken in claiming a forest fire did no damage to mature timber. In order to get the facts a professional forester was engaged to make an appraisal.

In making the appraisal the factors considered were: (1) Establishment to the satisfaction of the government the true burned acreage involved. (2) Determination of the value of stumpage on the particular tract on March 1, 1913. (3) How best to make a representative survey at a cost consistent with the comparatively small sum in dispute. (4) Proof of which trees were lost by this particular fire. (5) Estimate of the board foot contents as of March 1, 1913. (6) Computation of the average loss per acre and the total loss for the area burned.

The loss of 2,135 acres burned was by 13 separate fires. Since the Tennessee Forestry Department had checked the size, location was made on the U.S.G.S. maps of the quadrangle in question by the District State Forester. Only an actual survey of the fires would have been better. This was out of the question because of the comparative cost involved.

To determine the value of stumpage in 1913 lumber firms who were operating in the area at that time and landowners were requested to furnish estimates. From five responses the price varied between $2 and $10 per M. It was decided $5 would be a fair value at that time.

Again because of the limited allowance for the appraisal no chain and compass survey could be attempted. Representative burned areas were explored and a

erage ¼-acre sample plots chosen. On these all injured trees which could have been 10 inches or over d.b.h. in 1913 were considered.

Since most of the land had been burned over more than once in the years since 1913, trees with old burn scars were tallied in one section of the notes and trees with new burn scars in another section. Volume of trees with old burn scars were not in the final computations but were recorded as indicative of the cumulative damage of fire. The stands had mostly been logged over. Large trees left standing remained because of diameter limits in cutting or as seed trees. The logging chance being poor in very rough topography it was considered any trees injured sufficiently to cause death in the next twenty years had no salvage value. Specimens with one to three square feet of loosened bark near the base were judged as lost by this fire. Photographs were taken showing basal damage.

The d.b.h. was measured with a diameter tape and the merchantable log length taken with an hypsometer. An increment borer produced cores from which the d.b.h. was procured as of 1913. Volume tables as contained in Technical Note No. 19, Appalachian Forest Experiment Station, and bark variation tables from the same source were used in calculations of the merchantable board feet volume in 1913.

The result of the computations showed a loss of $4.63 per acre. Existence of much down chestnut throughout the stands caused extremely hot fires with resulting heavy damage to the base of living trees.

A similar study of loss by fires in 1936 was made showing the average to be $5.73 per acre. Due to extreme drouth in the spring of this year fires were especially hot. Green leaves burned on deciduous trees during that period.

The resulting figures given above would, of course, vary greatly with density of stand, but might well be considered average for cut-over mountain land of the Southern Appalachians where scattered seed trees still remain and cutting to a diameter limit has been practised.

B. H. Bentley,
Middlesboro, Ky.

Watering Reduces Soil-Surface Temperatures[1]

During the hot dry summer of 1936 many nurserymen in the North Central region turned on their overhead sprinkling systems during the day, with the idea of reducing the excessive soil-surface temperatures which would cause direct heat injury to small seedlings.

The effectiveness of such a measure depends, of course, on (1) wind, (2) degree of cloudiness, (3) humidity, (4) air and soil temperature, (5) soil texture (water-holding capacity), (6) soil color, (7) soil moisture content before and after watering, (8) length of watering time, (9) time of application, and (10) type of shade used.

To test the effectiveness of such watering, a brief study was made by J. H. Stoeckeler in the U. S. Forest Service nursery at Towner, N. D., on July 6, 1936. The soil there consists of 6-8 inches of almost black, loamy sand (10 per cent silt and clay) over a substratum of sand, and due to the dark color, becomes very hot.

As is shown in the graph below, daytime watering in this nursery has been found of considerable aid in reducing soil-surface temperatures and attendant heat injury to small seedlings of ponderosa pine, 30 to 50 days old, which

[1]Technical note 126. Lake States Forest Experiment Station. Maintained by the U. S. Department of Agriculture in cooperation with the University of Minnesota.

showed definite lesions on the southwest side of the stems when the soil-surface temperatures were about 120° F.

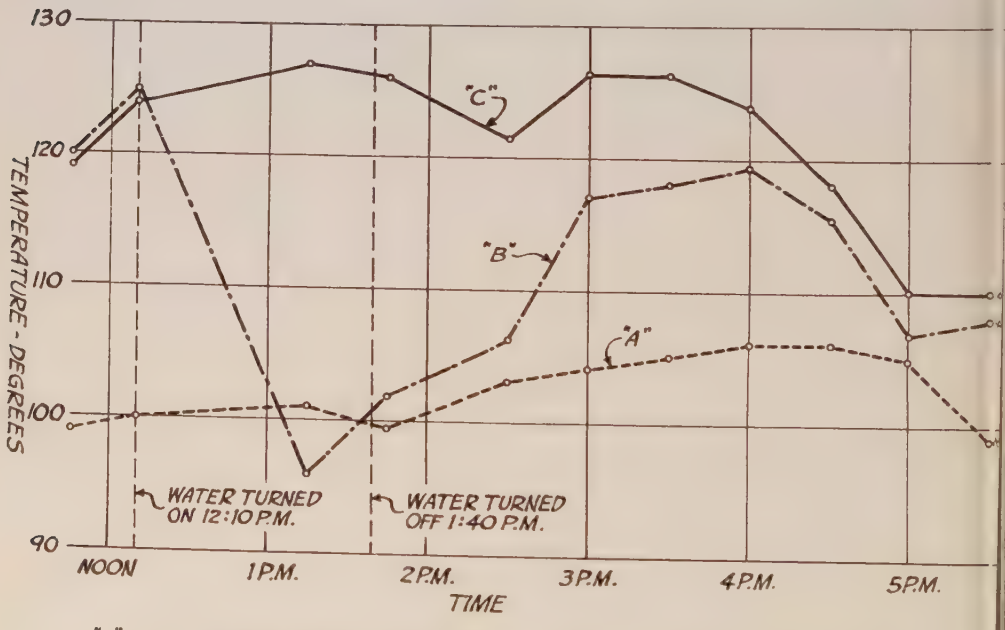
The graph also indicates that to get the maximum cooling benefit of such watering on loamy sand or light sandy loams, the overhead system during mid-summer should be operated for an hour twice during the day. These periods preferably should begin at about 10:30 A.M. and at 1:30 P.M.

In some nurseries with soils of finer texture and consequently higher water-holding capacity, one watering period of about 2 hours, beginning between 10 and 11:30 A.M., would probably suffice to hold down the soil-surface temperature below the danger point. The presence or absence of half shade and others of the nine factors mentioned above, would, of course, also determine the time and length of watering period which is most effective in a given nursery. This can be easily determined by any nursery superintendent with the aid of a few thermometers which are laid on the surface of the soil in a watered and unwatered block and read periodically.

Since the water so used is largely evaporated, daytime watering should be considered largely as a method of "cooling" the soil surface and not for supplying water for plant growth. Watering for the latter purpose is more effective if done at night.

Rule of Thumb for Converting Tree Volumes from One Log Rule to Another

Data collected during 1936 and 1937 on timber sales in the Duke Forest, for the purpose of a log rule comparison and for a check on scaling practice, provided some interesting information on the total



"A" AIR TEMPERATURES IN SHADE.
"B" SOIL SURFACE TEMPERATURES IN SUN WITH 1½ HOURS OF WETTING.
"C" SOIL SURFACE TEMPERATURES IN SUN WITH NO WETTING.

Fig. 1.—Effect of watering on soil surface temperatures, Towner, N. D., July 6, 1936.

board-foot content of trees of different diameter classes.

The data were collected from 110 trees of loblolly pine (*Pinus taeda*) and shortleaf pine (*Pinus echinata*). The trees were bucked into logs of 10, 12, 14, 16, and 18 foot lengths to obtain maximum utilization. The logs were scaled and an average gross board-foot content per diameter class was found by each rule. The total board-foot volume per tree is somewhat larger than volumes heretofore published for the southern pines, probably because the trees were utilized to small top diameters.

During the course of the study it was found that a constant relationship exists between the total board-foot volumes obtained when a tree is scaled by the Scribner, Doyle, and International log rules. The relationship can be expressed as the ratio between the volume, by either the Scribner or Doyle rule, of a 16-foot log, having a top diameter (inside bark) equal to the diameter (breast high, outside bark) of the tree, to the volume of a 16-foot log of the same diameter by the International rule, less a constant. This constant is 3.5 per cent when the Scribner rule is compared to the International and 15 per cent when comparing the Doyle and International rules. The above

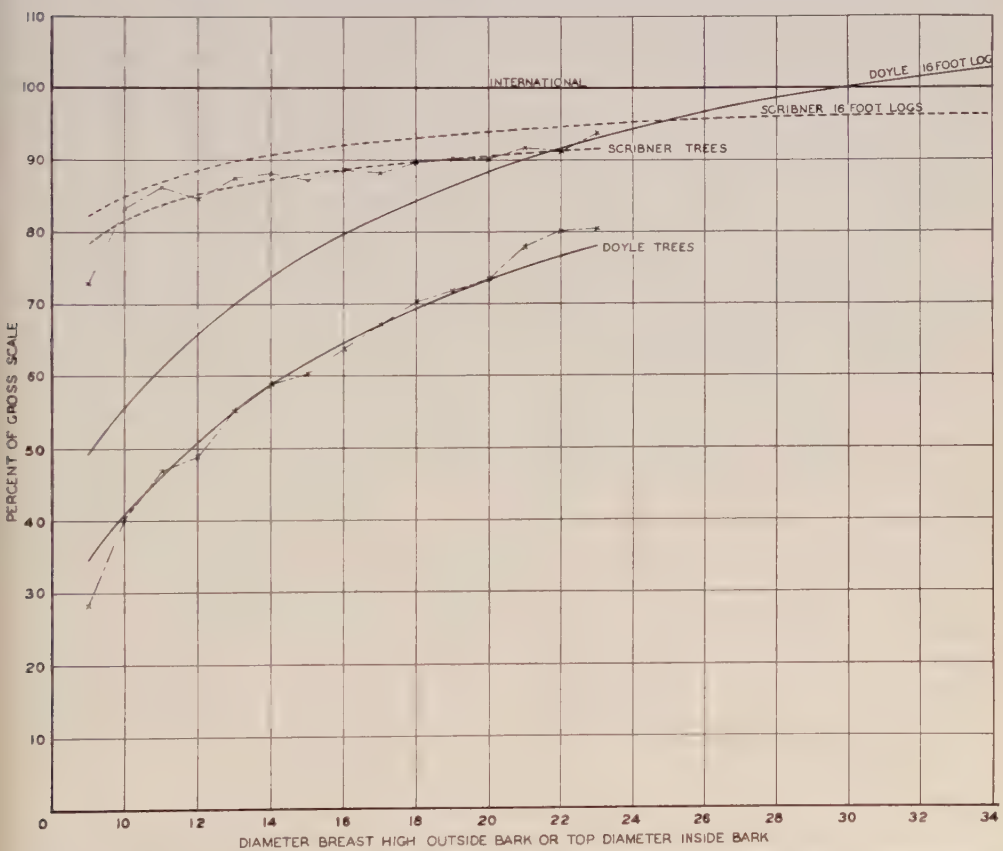


Fig. 1.—Showing that the ratio of a tree volume by the Scribner or Doyle rule to the volume by the International rule, may be expressed as the ratio of the volume of a 16-foot log [top diameter (inside bark) same as diameter breast high (outside bark)] when scaled by the same rule, to its volume by the International rule less a constant. The constant is, for the Scribner rule, 3.5 per cent and, for the Doyle rule, 15 per cent.

information can be used as a rule of thumb for quickly converting the board-foot volume of a tree, when scaled by one log rule, to the volume that would be obtained if another rule were used.

For present purposes, the precision of volume estimates of small logs according to published tables of either the International or the Scribner log rules is not sufficient; in the case of the International rule because volumes have been rounded off to the nearest 5 board feet, and in the Scribner rule because volumes, as originally estimated from diagrams, have not been smoothed with respect to the diameter of the log. Log tables according to these rules were therefore based upon the following formulae:

Scribner: $V=(.79D^2-2D-4)\frac{L}{16}$.

International, ¼-inch kerf: $V=.905\ (.22D^2-.71D)$ for each 4-foot section with taper allowance of ½-inch to each section

In the percentage comparison (Fig. 1) the International rule is assumed as 100 per cent. On a mill scale check of about 11 M board feet this rule gave an overrun of less than 1 per cent, and this rule is generally accepted as giving the most accurate measure of the actual board-foot content of sound logs. To obtain the values for the Scribner rule the board-foot content per diameter or top diameter class was divided by the board-foot content for the diameter or top diameter class as given by the International rule. In obtaining figures for the Doyle rule the same process was used substituting the Doyle for the Scribner rule. Curves through the plotted data for trees paralleled the curves of the 16-foot logs so closely that a constant was set up for each rule.

An example best illustrates how this information can be used quickly to convert volumes of trees from one rule to another. If the volume of a tree by the International rule is given and the volume by the Scribner rule is desired, the ratio between volumes of 16-foot logs by the respective rules is found by dividing the volume according to the Scribner rule by the volume as determined by the International rule. This percentage, less the Scribner-International constant (3.5 per cent), is multiplied by the volume of the tree given by the International rule.

The writer is indebted to Professors William Maughan and F. X. Schumacher of Duke University for advice and assistance in this study.

Example:

Volume of a 15-inch tree by the International rule=262 board feet.
Volume of a 15-inch, 16-foot log by the International rule=157 board feet.
Volume of a 15-inch, 16-foot log by the Scribner rule=144 board feet.
Volume of a 15-inch, 16-foot log by the Doyle rule=121 board feet.

To obtain volume of a 15-inch tree by the Scribner rule: $\frac{144}{157}=0.917$. $(0.917-0.035)\ 262=231$ board feet.

To obtain volume of a 15-inch tree by the Doyle rule: $\frac{121}{157}=0.77$. $(0.77-0.15)\ 262=162$ board feet.

Carlton J. Blades,
Duke University.

A Coordination of Loading Time and Hauling Distance in Truck Logging

The motor truck and trailer has become an important unit in revolutionizing the transportation problem in the logging of commercial timber throughout the country. Timber stands, which a few years ago were considered inaccessible for commercial logging because of prohibitive transportation costs, have since become profitable logging chances. Marked development of road building machinery resulting in cheaper road construction costs and better construction of motor trucks and trailers designed to carry heavy loads at fair rates of speed have been determining factors in this rapid change in the transporting of raw forest products.

Efficient coordination between hauling and loading units is necessary to reduce lost time and delays, which is an important item in truck logging. Since the cost of an operation remains practically constant, any improvement in coordinating equipment and man power which results in increased output is a factor with which every operator is concerned. Maximum efficiency is attained only when all units involved are so coordinated that non-effective time is eliminated or reduced to a minimum.

Truck hauling output, like many other transportation methods, depends upon a number of factors: logs per M, efficiency of loading crew, capacity of loader, kind of trucks, condition of roads, speed miles per hour, etc. When these factors have been determined for any one operation, they become practically fixed; such as volume per load, trips per day, and capacity of loader.

Travel time depends upon speed miles per hour and length of haul. The longer the haul, the more trucks are required to keep the loader and crew busy. Naturally, the object is to have a sufficient number of trucks hauling and not more than required for the length of haul and capacity of loader. More than that number, of course, results in excessive hauling costs and too few means lost time for loading crew.

Unavoidable delays occur in any operation at times and have a tendency to upset a calculated schedule; however, by knowing the loading time, unloading time, distance of haul, average speed miles per hour, a balance point can be determined for truck hauling and loading correlated with distance. The number of trucks required for any length of haul may be determined by expressing these values in a formula:

$$T=\frac{L+H+U}{L}=\left(\frac{\frac{M}{S}+U}{L}\right)+1$$

T = Number of trucks required
M = Total miles in round trip
S = Average speed miles per hour
L = *Loading Time*
$H=\frac{M}{S}$ = Hauling time
U = Time required for one truck to unload, load trailer, and turn

The time required to load a number of trucks hauling should equal the time required for one truck to haul, unload, load trailer, turn, and return to loader. Travel time is equal to the total miles, round trip, divided by speed miles per hour, which is equivalent to the time required to load all of the other trucks hauling, less the time required for one truck to unload, load trailer, and turn, thus:

$$\text{Travel time} = \frac{M}{S} = [(T-1)\ (L)]-U$$

To illustrate. Assuming an operation where distance of a haul will be 3.9 miles, over an ordinary dirt road, and speed of truck travel averages 13 miles per hour for a light truck and dual axle trailer, the average travel time per trip will be:

$$\frac{7.8}{13} = .60 \text{ hour}$$

Capacity of the loader approximately 10,000 b.f. per hour; loading time per truck

.416 hour (25 minutes) for average loads of 4 M; unloading time, loading trailer, and turn .233 hour (14 minutes).

The number of trucks required then, for this length of haul, depends upon the number that can be loaded while one truck hauls, unloads, loads trailer, turns, and returns to the loader. The total time required would be .60 hour travel time, plus .233 hour for unloading, loading trailer, and turn, or .833 hour.

The loading time is .416 hour for each truck load, or two trucks can be loaded while the third hauls, unloads, loads trailer, turns, and returns to the loader. By the formula:

$$T=\left(\frac{\frac{7.3}{13}+.233}{.416}\right)+1$$

$$T=\left(\frac{.833}{.416}\right)+1$$

$$T=3$$

Three trucks would just keep the loader and crew busy for this length haul assuming no delays would occur other than those accounted for.

Taking a haul of 12 miles, speed per hour of 13 miles as before, the number of trucks required would be:

$$T=\left(\frac{\frac{24}{13}+.233}{.416}\right)+1$$

$$T=\left(\frac{2.079}{.416}\right)+1$$

$$T=4.99+1 \text{ or } 6 \text{ trucks}$$

The answer in number of trucks will in many cases result in a whole number and a fractional part of another which may be carried or dropped depending upon its weight.

C. W. Bloom,
Montana School of Forestry.

Study of Growth Rings

Professor Edwin L. Moseley, curator of the museum at Bowling Green State University, has examined the annual rings on large logs in many mill yards, and on hundreds of stumps. He finds on many of them single rings, or groups of rings, which are outstanding for their width, indicating that the trees were getting more moisture at the time these rings of wood were formed. One such period began in 1846, another 90 years earlier, 1756. At several places in Ohio precipitation records were made as early as 1846; they show heavy rainfall 1846-1852. The same is true of one or more places in Kentucky, Wisconsin, Iowa, Missouri, Kansas, Texas, Louisiana, and Mississippi. At Cincinnati in 1847 was the greatest rainfall in the entire record of over a hundred years, 65.18 inches. This was 90 years prior to the present wet year. In the seven years beginning with 1846 there were six floods recorded at Pittsburgh, which is as many as the record shows for more than half a century prior to that. All of the eight floods recorded there, 1762-1840, were followed by floods approximately ninety years later.

The reason for the 90 year precipitation cycle is believed to be the sun's influence on climate. Ninety is a simple multiple of the sun-spot period.

In order that Professor Moseley may continue this study and have tangible evidence that will convince other scientists, the university would like to obtain sections from large logs or stumps of any species if they show plainly as many as 300 rings. The section may go entirely across or only to the center. It need be only thick enough to hold together. In squaring the butt end of a log enough could be saved without lessening the number of board feet it will make.

Specimens should be marked Sample Collect, and sent by express to the University Museum, Bowling Green, Ohio.

REVIEWS

German Forestry. By Franz Heske, *342 pp. Illus. Yale University Press, New Haven. 1938. Price $3.*

This timely and worthful book, published for the Oberlaender Trust of the Carl Schurz Memorial Foundation for the primary purpose of making the experiences of the German-speaking peoples in the field of forestry available to the American people, is not the product of the author alone. The original manuscript was written in German by Prof. Franz Heske of the Tharandt Forest School in Saxony, which is acclaimed by the author as the oldest forest school of academic rank in the world. The preliminary translation of the text material was made by Prof. A. B. Recknagel of Cornell University and the final translation by William N. Sparhawk of the U. S. Forest Service. Wilbur K. Thomas, Director of the Carl Schurz Memorial Foundation, supplied the Foreword. Dean Henry S. Graves of the Yale Forest School wrote the Preface and Robert B. Goodman, Chairman of the State Conservation Commission of Wisconsin contributed the nine-page Introduction. Most of the 28 illustrations were supplied by American foresters or American forestry organizations.

In this first comprehensive book on German forestry published in the English language, Dr. Heske presents a picture of the forest situation in Germany, traces the development of German forestry especially in the fields of forest economics, policy and administration, evaluates important forestry procedures and practices, discusses significant current trends in forestry, and shows how forests and forestry have had a profound influence in the economic and cultural life of the German people.

The book is divided into two main parts of fourteen chapters each. Part I carries the general title of German Forests and Forestry, and Part II is entitled German Forest Policies. Among the chapter headings of Part I are Present Land Use in Germany, Development of Sustained-yield Forestry, Ownership of German Forests, Products of German Forests, Meeting Germany's Timber Requirements, Increasing the Timber Yields of German Forests, Management of State Forests, Management of Communal Forests, and Management of Private Forests. The American reader may wonder why there is no separate chapter on national forest management. The answer is simple, for there are practically no national forests in Germany. Of the more than 31 million acres of forest land in the Reich (the recent Austrian annexation not included) only 80,600 acres are in national forests. The national forests of Germany comprise less than three-tenths of one per cent of the total forest area.

Among the principal chapter headings of Part II are Forestry Agencies, Forestry Science in Germany, Forestry Education in Germany, Recent German Labor Legislation in Relation to Forestry, Tenure of Forest Property, Forest Rights, Adjustment of Population to Land, State Restrictions on Forest Management, National Forestry Legislation, the Development of Forest Taxation, Forest Fires and Forest Fire Insurance, Forest Credits, and Forest Reserve Funds.

Of special interest is Chapter 15, entitled Forestry Agencies. Dr. Heske points out that until recently forestry in Germany

was the concern of the individual states rather than the federal government, and that in the past the federal government was not organized to take care of even those forestry matters which affected the interests of the nation as a whole. Until 1919 there was no separate administrative set-up anywhere in the federal government of Germany empowered to deal with forestry matters, and for more than ten years after the first federal administrative unit for forestry was established, forestry was given a subordinate place among governmental activities. In 1933 for the first time a division of Forestry and Forest Industries was created in the federal Department of Food Supply and Agriculture. In 1934 general jurisdiction over forestry and hunting was transferred from the states to the Reich, and a federal Department of Forestry and Hunting was established. A year later matters concerning forest industries were added to the new department, now headed by a Chief Forester (*Reichsforstmeister*). While the administration of public forests and the general supervision of privately-owned forests is now carried on in the newly created Department of Forestry and Hunting, the actual oversight over private forests, especially farm woodlots, remains in the forestry division of the Department of Food Supply and Agriculture. In addition to strictly governmental agencies for forest administration, the National Socialist Party has its own forestry agency setup primarily "to coordinate the entire German forestry structure." A separate National Forestry Commission, and since 1934 a National Commission for Forest Products Industries are also in operation.

These recent administrative developments in German forestry are especially interesting in the United States at the present time, when matters of federal administrative reorganization are in the forefront of public discussion. Dr. Heske summarizes his point of view on administrative management for forestry as follows:

"Forest administration in Germany, as indeed is the case in most other countries, seldom was sufficiently independent properly to perform its special functions. It was always dependent to some degree on the Department of Agriculture or on the Ministry of Finance or some other department. It was always a sort of appendage and as such was restricted in its development. This dependence on other agencies proved particularly detrimental. * * * Its importance and its needs are seldom clearly understood by persons belonging to other branches of economy, even by agriculturists. Therefore, the greatest possible degree of independence in the governmental administration is virtually a prerequisite for the proper development of forestry."

The author stresses the need for a comprehensive national forest law. In the appendix appears the text of such a law proposed in 1920, but which failed of enactment because of strong opposition by the individual states. The present government is, however, approaching this federal forestry problem in a serious way. Already three important national forest laws have been enacted, namely, the forest devastation law, the law of forest tree races, and the law transferring the jurisdiction over forestry and wildlife management to the federal government. And of special significance is the master national forest law now in process of preparation. Of special interest also is the chapter on Employment in Forestry. The author points out that "the volume of employment in forestry and the wood using industries is of very great significance for the political economy of Germany." He reports that in 1925 approximately the equivalent of 1,500,000 persons fully employed were engaged in the growing, utilization, and marketing of forest products in Germany. The discussion of the character and volume of wood

work and the probable future location of wood-using industries should be helpful in the consideration of important economic and social problems in American forestry.

The separate chapters on Forest Taxation, Forest Fire Insurance, Forest Credits and Forest Reserve Funds contain interesting information and stimulating discussions, but after studying their contents one is impressed with the fact that even after several centuries of sustained development of forestry in Germany many perplexing problems remain unsolved. In these particular chapters there is little that is directly applicable to American conditions and practices.

It would be expecting too much to include all of German forestry in a single volume, but one wonders why wildlife management, which has always been an important part of forestry in Germany, is given so little consideration and it also appears that certain phases of utilization are treated in a rather briefed form. Unfortunately a strain of propaganda is spotted through the text and some of the statistics are out-of-date, such as the causes of forest fires from 1907-1923 (page 306) and the berry and mushroom crop of 1908 and 1915-1916. In a few places it is difficult to understand the author's point of view and purpose, when on page 205, for example, he writes that "An almost sacred fundamental characteristic of science, including forestry science, is freedom. Without freedom, science becomes a farce," and on page 226 in discussing the theory of leadership he emphasizes that the leaders' "authority in government rests neither on divine right nor on patriarchal rank nor does his authority in the economic sphere rest on ownership of the means of production. In all phases of life, the right to lead is derived solely from the spiritual and moral superiority of the leader."

Throughout this book occur many features of general and special merit that deserve serious consideration by American readers. In reporting on German forestry, Dr. Heske has made a significant and enduring contribution to American forestry. "German Forestry" should be widely read and studied by foresters, forest owners, and others interested in forestry and closely related conservation activities.

JOSEPH S. ILLICK,
New York State College of Forestry.

Economic Aspects of the Forests and Forest Industries of Canada. By J. D. B. Harrison. *Canada Dept. of Mines and Resources; Lands, Parks and Forests Branch, Bull. 92, 53 pp. 1938.*

In a concisely written opening chapter, Mr. Harrison, of the Forest Economics Division of the Dominion Forest Service, has brought together vital statistics on the forest resources, depletion and growth in Canada. The importance of these resources is attested by the fact that the forested area of Canada is greater than that of any other country, excepting Russia and Brazil. The total merchantable stand is 274 billion cubic feet, of which 222 billion is conifers. The average annual cut of forest products in the 10 years 1926-35 was 2½ billion cubic feet, or less than 1 per cent of the total volume. Of this, logs and bolts were 34 per cent, pulpwood 25 per cent and fuelwood 34 per cent. The average annual value of these products was almost $160,000,000.

Chapter II deals with the forest industries. In 1935 these employed 168,427 persons, with salaries and wages totalling $144,000,000, and represented a capital investment of $889,000,000. Canada excels in newsprint production and is important in other branches of paper manufacture.

Chapter III, "External Trade and Home Consumption," shows that "the products of the forests and the forest industries provided the largest favourable balance in external trade during the period 1931-35."

This publication is a credit to the author and to the Dominion Forest Service and capably fills a long-felt want.

A. B. RECKNAGEL,
University of British Columbia.

The Forest Resources of British Columbia, 1937. By F. D. Mulholland. *153 pp. Illus. 6 maps. Department of Lands, British Columbia Forest Service, Victoria, B. C. 1937.*

In a well-written and well-illustrated bulletin, Mr. Mulholland, Chief of the Division of Forest Surveys and Working Plans of the British Columbia Forest Service, has brought together a wealth of information on the forest resources of Canada's Pacific Coast Province. In a sense it is a revision of the 20-year-old work: "The Forests of British Columbia" by Whitford and Craig, but it is far more than that. It presents a new inventory of the forest resources and a new classification of the land with respect to forestry. This inventory, this classification, required a decade of study, purposeful work. The results speak for themselves. Here is a complete timber inventory of the Province.

The bulletin starts with a general description of the topography, geology and climate of British Columbia, followed by chapters on "Forest Types" and on the "Trees of Commercial Importance." Chapter IV treats the "Ownership of Forest"—the picture is that of a Province which owns 93 per cent of the 75 million acres of productive forest land and 90 per cent of the merchantable timber. "Many of these (timber) licenses," says Mulholland, "have been allowed to lapse after completion of logging, or because the holders of less accessible licenses have not considered the speculative value high enough to justify the payment of annual rentals until their timber could be exploited." There were 15,000 licenses in 1907; 3,700 licenses are in good standing today.

The chapter on "Forest Resources" is of great statistical interest. Throughout the bulletin "Coast" and "Interior" are differentiated. Of the 230 million acres of land in British Columbia, only 4.7 million is agricultural, 22.7 million has mature timber (1/3 on Coast, 2/3 in Interior), some 37 million bears immature timber, and 20 million acres is deforested. Besides, there are 66 million acres of barren, 82 million acres of scrub growth (which "may at some future date have a value in some market not yet apparent") and more than 2 million acres of swamp. These three categories account for the 150 million acres of non-productive areas.

Of the 254 billion board feet of merchantable timber, less than half (109.7 billion) is rated as accessible. Of this, 2/3 is on the Coast and 1/3 in the Interior. The accessible Coast timber is, of course, the most important commercially.

The sixth chapter deals with growth, depletion and possibilities of sustained yield. Unlike American conditions, where most timber operators own the land they log, the loggers of British Columbia have mostly been, so Mulholland avers, "tenants interested only in the mature timber, leaving consideration for a second crop to the Crown, a landlord who has been chiefly concerned with making the natural resources support the cost of development of a new country." And so he finds, "The forest industries have been organized to liquidate the 'frozen capital' in overmature timber as quickly as economic conditions will allow."

Coming to sustained yield, Mulholland construes it as "simply the continuou

regional production of wood for stable permanent industries" and hopes that by dividing the forest land into comparatively large units, provision being made for natural reforestation to take place after logging, the rate of logging may be calculated so as "not to dispose of all the virgin timber until an approximately equal rate of cutting will be possible in the second growth." He hopes to attain this with a 100-year rotation and by dividing the merchantable timber by 100 and adding the yearly increment, he finds that "the industries are already overcutting the accessible Coast forests by 100 per cent and the accessible and inaccessible combined by 20 per cent." He adds, significantly, that: "the Coast industries must largely stand or fall with the Coast forests."

The reviewer is not inclined to quarrel with these figures, but questions whether they serve more than a speculative purpose. It seems idle, for example, as Mulholland admits, to attempt to limit depletion on the Coast to 1,032 million feet when, in 1936, it was 2,700 million. Who can foretell what conditions will be in the year 2038? Meanwhile, the economic needs of the Province for revenue and the pressure for liquidation will probably dictate the course to be pursued.

Mulholland recognizes this conflict and urges "increased effort . . . to conserve the remaining virgin timber by reduction of waste." Elsewhere he hints at "obligatory reforestation and technical assistance" as means whereby "the State could encourage private forestry."

The chapter on Insect Injury, contributed by Dr. Hopping, makes grim reading. Then follows a chapter analyzing the resources of each of the 5 Forest Districts—namely: Vancouver, Prince Rupert, Fort George, Kamloops and Nelson. No attempt is made to cover the unorganized 68 million acres in the northern interior.

Concluding chapters deal with Provincial Forests (set aside as forest reserves, now aggregating 4½ million acres on the Coast and 10½ million in the Interior), Miscellaneous Tables, and Inventory Methods.

The bulletin is not only authoritative in its statistics but challenging in its conclusions. Something must be done to keep British Columbia's forests continuously productive. Mulholland has pointed the way, that of self-regulation. It remains to be seen how far his recommendations will be followed.

A. B. Recknagel,
University of British Columbia.

West Virginia's Renewable Natural Resources and the Public School Student. Prepared by Educational Division of the Conservation Commission of West Virginia. *Pp. 3-31. Charleston, W. Va. 1937.*

In these days of wide-spread interest in conservation, it is gratifying to note the extent to which its concepts are being worked out for schoolroom use. The subject, long a curriculum stepchild, is now occupying a place of major importance in the teaching scheme.

An approach to conservation teaching is being made by the Conservation Commission of West Virginia in cooperation with the fifth to eighth grade teachers of the state's free schools. Instead of setting up a hard and fast instruction program, the Educational Division of the Commission suggests as objectives the use of conservation ideas pertinent to the state—the objectives to be realized through the development of individual experiences, class projects, and the classroom discussion of topics centering upon West Virginia's conservation problems.

The current bulletin is tentative in nature. It is meant for use as source material in the fields of elementary science, civics, history, geography, economics, and

art. In it some prefatory material, dealing with the extent of West Virginia's natural resources and the need for conservation instruction in the public schools, is followed by a teaching set-up organized in activity units such as: Wildlife, Forests, Man; Fire in the Forest, Man's Enemy; and Conservation, A Problem each Person Must Help Meet. Each unit is analyzed in terms of its objectives. Following the unit analyses are suggested methods for arriving at understandings of them. An appendix contains descriptions of motion pictures for classroom projection and lists of fish, birds, and mammals native to the state. The well-organized bibliography directs teachers to additional source materials of value in planning class assignments.

At the end of the current school year, teachers who have used the bulletin will send their criticisms of it and suggestions for its improvement to their county committee of teachers. The fifty-five county committees, in turn, will report to the central state committee so that the bulletin can be revised as a permanent outline on conservation. Schools still on the nature-study level of conservation teaching might well follow West Virginia's lead in attempting to develop a worthwhile conservation teaching program.

John F. Lewis,
Connellsville High School,
Connellsville, Penna.

Skogsuppskattning och Skogsekonomi (Forest Mensuration and Forest Economics). By Sven Petrini. *277 + 3 pp. Lars Hökerbergs Bokförlag, Stockholm. 1937. Price 10 kronor.*

This attractively bound volume is primarily for the use of civil engineering students at the Swedish Royal Technical College where the author has given a course in this subject since 1934. He is known to many American foresters as the chief assistant at the Swedish Forest Experiment Station, the General Secretary of the International Union of Forest Research Organizations. In the latter capacity he has an exceptional opportunity to become familiar with forest research and forest literature in all lands. His own field of research has involved the continual use of mathematics in computing and reporting the results of permanent sample plot yield studies.

The book is in two parts, Mensuration and Economics. Many of the 23 chapters are but a page or two in length, but contain a surprising amount of concentrated information. The prominence of mathematics, with numerous formulae, will be accepted as a matter of course by the well-grounded students for whom the book is intended, but might well make difficult reading for an American student taking a general forestry course. In the opening discussion on tree form and measurement of individual trees, Henrik Petterson's, Behre's and Tirén's formulae are included along with the older equations. The author states that Behre's formula gives better results for Norway spruce and Scotch pine than Höjer's, although Tirén's is still better for the latter species. These modern formulae are not in practical use in Sweden mainly because Tor Jonson's tables, based on Höjer's formula, are generally used. As the book deals chiefly with conditions in Sweden, emphasis is placed on the details of tree form in different parts of that country.

The estimation of stand volume is based on the mean sample tree method with the Swedish methods for determining log yields of trees of different d.b.h. The chapter on growth is based on that found in Practical Forestry Handbook (Stockholm, 1924). Pressler's, Jonson's and the compound interest formulae for growth per cent are compared. The viewpoint of a "going concern" forest, which per-

vades the entire book, is nowhere better illustrated than in the explanation of "exploitation per cent," defined as "the annual cut, computed at the end of the year, in per cent of the growing stock at the end of the same year before cutting." Under the heading "Estimation of site quality" "density" and "intensity" are distinguished, the latter being the percentage of solid wood in a parallelopiped with a basal area of 1 hectare and an altitude equal to the height of the forest. Mathews' "spacing figure" is cited as a valuable expression for density. Limits of accuracy in mapping and estimating by strip survey receive attention.

Working plans are discussed in 4 pages, concerned chiefly with division of growing stock into mature and immature timber classes. Calculation of the cut includes Tor Jonson's formula for annual cut, Erik Ronge's, Oscar Lindblad's and Wallmo's, and the French *quartier bleu*, more familiar to American foresters. Finally, the relation between annual cutting per cent and exploitation per cent is explained, with tables for computing each.

The chapters on forest economics include much of what is termed forest valuation or finance in America. The peculiar nature of the forest investment is described in the light of various economic theories. Where sustained-yield private forestry has been practiced on as sound a business basis as in Sweden figures on the cost of forestry are available, such as are still rare in America. For instance, over a period of 20 years about 30 per cent of the net return from stumpage from a 1,200-acre estate forest in which about 4 per cent of the growing stock was cut annually was absorbed in administrative costs, distributed as follows:

Average annual overhead costs	Per cent of total	Per cent of net stumpage income	Cost per acre
Administration	32	9.6	$.24
Protection, patrol, scaling, etc.	18	5.3	.13
Yield tax on timber cut	6	1.8	.04
Forest Conservation Board fees	4	1.2	.03
True taxes	18	5.2	.13
(a) Town real estate 68%			
(b) County real estate 10%			
(c) Road tax 22%			
Fence maintenance (labor only)	5	1.3	.03
Roads (exclusive of public road tax)	11	3.3	.08
Reforestation	4	1.4	.03
Mapping, estimating, working plans	2	0.4	.01
Totals	100	29.5	$0.72

Changes in the value of forest soil and soil rent due to alterations in methods of cutting and reproduction are treated in a comprehensive manner. A chapter is also devoted to the calculation of the financial benefits of ditching marshy land. Forest taxation in Sweden is fully discussed. The volume closes with chapters on calculation of the profit and loss from forestry and appraisal of forests and forest land for sale.

Petrini has contrived to pack an enormous amount of information into a small space, much of it new to American foresters, and a considerable part of it related to peculiar Swedish conditions. In the projected English edition of this book, which, it is hoped, may soon be forthcoming, some of these sections will be replaced by those of more general application. Even as it stands it is a fine brief text and reference volume for any forester, especially for those conducting private enterprises which are not static, but are on an operating basis.

HENRY I. BALDWIN.

Skogsbrukets ekonomi, Nagra synpunkter-särskilt med hänsyn till forhallandena i mellersta Sverige. (Forest Economics.) By Oscar Lindblad. *Skogen 24:458-461. 1937.*

Although written from the standpoint of commercial forestry in Sweden, the ideas expressed in this paper are appli-

cable to commercial forestry in this country.

The author points out that it is not enough to obtain maximum volume production, but that commercial forestry also requires the maintenance of production according to the best scientific principles so that the greatest possible sustained returns may be received. Furthermore, sustained maximum volume production may not fulfill all obligations of forestry, for if the costs are too great the result will be unsatisfactory. Economic considerations will govern sound forestry practice. Good forest management depends upon a consideration and blending of the biological, technical, and economic viewpoints. It is a mistake for a forester to concentrate his efforts along any one of these lines at the expense of the others.

Economy in forestry demands that the income should be as high and the cost as low as possible. It means that everyone concerned with the enterprise from the woods laborer to the entrepreneur should be motivated and guided by economic considerations. As much depends upon prediction, the forester must have good judgment. Even though he must frequently decide on the basis of uncertain calculations, future expectations must be appraised in the light of all available evidence. It is preferable to sell timber products as far as possible when prices are high and to hold the forest intact when prices are low. Small properties have an advantage in this respect, for the large properties have complicated and extensive business structures to maintain and greater supplies of labor requiring steady employment.

It is always necessary to realize the maximum value from every tree. This may not mean much for one tree, but for many it is of great importance. It is necessary to study the markets for different products such as sawtimber, pulpwood, and firewood, and to ascertain the lowest diameter below which it is not profitable to cut the timber. The transportation costs according to various diameters should also be considered. Timber cutting should always consider bettering the quality and increasing the production of the remaining stand. Trees should be left which will be worth more in the future through growth than their present sale value. Thus trees which within a short time will grow from a size suitable for a product of relatively low value, such as pulpwood, to a product of relatively high value, such as sawtimber, should especially be conserved.

During the past 20 years heavy thinnings have been generally recommended for young stands, but now light thinnings are preferred in many instances. As the volume of a typical 30 to 40-year-old stand will increase about 8 per cent annually while the growth in value goes up to 10 or 15 per cent, the reduction in productive capacity through heavy thinnings is uneconomic. Although undesirable trees should be removed from young and middle-aged stands the general proposition still holds true that as large a timber capital as possible should be left growing on the tract. With older stands, however, it is economically desirable to make cuttings sufficiently heavy that substantially the same returns will be received year after year.

The cost of clearing winter roads can usually be figured to be paid back through cheaper transportation. As for summer roads, it is generally better to have long roads of less costly construction than short, expensive roads, because all necessary log hauling can usually be done during the freezing months of winter and a couple of months when it is dry and hard in summer.

The determination of the economic results under forest management is a complicated matter. The actual income received is readily computed at the time the books are closed. However, unless the accounting process covers both capita

appreciation and capital reduction, it will have only limited value to the forest manager.

A. Z. Nelson,
U. S. Forest Service.
(*Based on translation by* P. A. Nelson.)

Forest Practice Handbook. By Joint Committee on Forest Conservation, West Coast Lumbermen's Association and Pacific Northwest Loggers' Association. *31 pp. Illus. Seattle, Wash. Revised October, 1937.*

This Handbook presents the regional program of forest conservation which has been adopted by the organizations of loggers and lumbermen in the Douglas fir region. It presents the parent program evolved by the Forest Conservation Conference (Washington, D. C., 1937) for the guidance of the nationally organized lumber industry. Most important, probably, is the fact that the material in this book consists largely of clearly and simply presented directions for and explanations of the successful techniques which have been tested and tried by forestry agencies in the Pacific Northwest.

Generally, expert opinion agrees that the problem of obtaining regeneration in the Douglas fir region is largely one of prompt slash disposal and exclusion of fires thereafter. The difference between immediate reproduction and adequate restocking from 7 to 10 years after logging may be, on certain sites, a matter of revised logging methods to provide better seed supplies. The Handbook contains as much as has been learned about this difficult problem.

The Table of Contents is indicative of the extremely practical character of the material: "The Essentials of Forest Conservation in the West Coast Region," "Rules of Forest Practice," "Fire Protection During and Immediately Following Logging," "Hazard Reduction," "Providing a Seed Supply," "Conservation of Immature Trees and Young Growth," "Partial or Selective Logging," "Sustained Yield Forest Management."

This Handbook is a product of the Joint Committee on Forest Conservation of the West Coast Lumbermen's Association and the Pacific Northwest Loggers Association, and was compiled by the technical staff with the assistance of the Committee, including advisory members from federal and state forestry and protective organizations.

John B. Woods,
National Lumber Manufacturers' Assn.

Profitable Management of Shortleaf and Loblolly Pine for Sustained Yield. By W. E. Bond, W. G. Wahlenberg, and Burt P. Kirkland. *Southern Forest Exp. Sta. Occasional Paper 70. 37 pp. (Multigraphed). 1937.*

This publication is of unusual interest and importance in that the authors explain and recommend technical forest management of a high order in terms that executives of timber-owning companies can readily grasp and apply. Predicated on the desirability of good forest management from a financial viewpoint, the brand of forestry recommended is plainly shown to be primarily for the benefit of the forest owners themselves. Congratulations are due the authors for hewing to the line and discussing profitable forest management without encumbering it with abstractions and social implications frequently confusing to the laymen seeking the truth. Their proposals obviously have been tested and proven in the crucible of actual practical operating conditions and, therefore, can be authoritatively recommended.

Briefly, the authors recommend a definite, yet flexible, plan of management predicated on selective cutting in cycles of not more than 10 years. Large properties would be divided into blocks and compartments and each unit would be cut in each cutting cycle. Preliminary determinations of the total volume and growth for the whole property are recommended so that the annual cut can be limited to the growth. Most forests, it is stated, need their growing stock built up, so at least 20 per cent of the total annual growth should remain uncut and added to capital.

After the general order of cutting in any one or more blocks has been determined, the annual cutting compartments are tentatively selected. Areas specified for cutting are fixed for only one or two years ahead because of frequent adjustments that must be made, particularly during the early stages of management. Selecting the trees to be cut is the key to successful culmination of the authors' plan and they devote considerable space in text and graphs to a full explanation of their methods. Naturally the total cut in any compartment cannot exceed the amount that the reserved stand will grow during the interval between cuts. The amount removed includes, first, the least desirable trees and, second, if additional volume can be removed, from those diameter classes that have more trees than the number recommended for the normal stand table. It is emphasized that a portion of the stand should be permitted to grow as large as 32 inches in diameter for the production of high-quality timber returning greater net income. Under such a system of cutting the quality and the growth of the forest greatly improve with each cut until the normal distribution of trees is attained and, logically, the profits likewise increase, as larger cuts of better-quality timber are obtained. The entirely practical measures that are proposed throughout and the due regard given to keeping costs in line with the ability of an ordinarily successful business to justify them are decidedly refreshing to the practical reader.

The importance of controlling the selective cutting is emphasized and it is shown that at a nominal cost of not more than ten cents per thousand feet of timber cut, a skilled marking crew under the supervision of a competent forester can select, mark, and tally 100 per cent of the trees to be cut and also tally all trees over 12 inches d.b.h. to be reserved. Thus, selective cutting is kept under exact control and accurate inventories are obtained of each compartment as it is cut. The cost is more than justified by the immediate savings in operating expense that is possible from planning the entire operation from logging roads to lumber sales on accurate knowledge of the timber to be cut each year or quarter.

Since it is obviously impossible to mention all subjects treated in the publication, many must be omitted from a review. Most procedure and information pertinent to organizing and developing forest management is, however, discussed by the authors. Limitation of space probably prevented more treatment of some important subjects such as the need for maps and road planning, which are mentioned. Their importance, however, would seem to justify lengthening the publication sufficiently to show what a vital part they play in the actual administration of sustained-yield management. For instance, air maps, which can now be obtained for larger properties for only a very few cents an acre, are exceedingly helpful in formulating and carrying out plans and in keeping executives fully informed of progress. These and other similar subjects might well be made the basis for another publication.

Of particular interest to foresters and those contemplating management of their forests is the chapter dealing with estimated costs and returns. It is shown, for

example, that starting with a stand of 2,982 board feet of saw timber per acre and following the authors' plan for 40 years, 7,960 board feet of saw timber can be cut with 5,536 feet of greatly improved timber capital on hand. In addition to the 7,960 feet cut, 3,140 will have been added to growing stock, making a total growth for the 40 years of 10,514 feet, or an average of 263 feet per year. The value of the annual growth is given as $1.07 per acre for the first 10-year cutting-cycle, $1.52 for the second, $1.97 for the third, and $2.42 for the fourth, averaging $1.75 for the 40-year period. Authentic information such as this is what sells the practical timber owner on forest management.

Minor criticisms of methods and treatment could be mentioned but they are hardly justified in the light of the real value of the publication as a whole and, therefore, are omitted. It is significant that the *Southern Lumberman* printed it in full in the December 1937 issue, with a statement from the Editor in bold type that it was the longest article they had ever printed (12 pages in small type) but that he considered it to be the most valuable article they had ever printed at any time and urged all to read it. This is high praise, indeed, in more ways than one, from a very practical source.

No review would be complete without constructive criticism of the form in which an important contribution like this is issued. It is released as Occasional Paper No. 70, comprising 37 pages of multigraph text and tables with 3 figures (stand table graphs). The pages are merely clipped together on the left side at three places leaving a frayed binding. Naturally, its physical appearance is uninteresting. This publication is a permanent contribution to forest management in the South and should be printed on good paper and fully illustrated to show visually what the authors have written about so well. Obviously it is aimed at interesting forest owners in forest management and supplies the facts. Good binding, paper, printing, and photographic illustrations would multiply its effectiveness many times over, making it a volume many would cherish and keep constantly at hand. Should a second edition be issued, there could be some improvement in text and more clarity in the figures and explanations. Also, perhaps, the philosophical discussion of the principles of sustained yield at the beginning and some other involved discussions of technique might be considerably briefed in consideration of non-technical readers.

Occasional Paper No. 70 should be included as required reading in forest management by every forest school in the United States and can be read profitably by all foresters and others concerned with or interested in sustained-yield forest management from the profit motive, reprehensible as that may be these days.

A. E. Wackerman.

CORRESPONDENCE

Editor's Note: When sending out his annual report the Chief Forester invited comments and criticisms of the report from those to whom it was sent. In response to this invitation the Forester undoubtedly received many comments. One of these written by Mr. P. S. Lovejoy is printed in full. Mr. F. A. Silcox's reply to Mr. Lovejoy is also printed in full. It is hoped that the publication of these two letters will contribute to a better understanding and appreciation of the Chief Forester's report and of the work and objectives of the Forest Service.

DEAR MR. SILCOX:

Your letter of January 10 inviting comment on your newly issued annual report seemed to be original typing; seemed also to be signed by you in ink. One looks closely of late at things coming out of Washington, especially if under frank. I couldn't be sure, but the evidences seemed to be that you were inviting my comment on the report. I wondered (frank for frank?) whether such comment might properly be direct instead of devious; but you had come asking it and I wouldn't want to bother being merely polite.

I wondered whether I could be sure what I really thought about what there would be in the report. Could I feel sure of what you and your Outfit really felt sure of—as contrasted with what you were just fumbling with or hunching at? Well, I'd look it over and mark it up en route; perhaps for local use as well as for you. But I'd have looked it over anyway, of course, as I have Forester's Reports ever since there have been any.

Most of my comment will be a sketch of things I found to wonder at en route. First I wondered at the bean-stalk effects. In 1907 we ran the Hell Gate (E) from a single small room with a piano box in which to store the pack-saddles, scale-sticks, calipers, etc. In 1917 I was attached to Zon's branch and our headquarters were in the blind end of an old hall in the Atlantic Building. So now I looked for your current book balances, finding them on the last two pages: "Expenditures $108 million . . . Net income to U. S. Treasury $3.6 million."

It would be correct New Deal technic, I presumed, to mention money last.

Page 14 said the National Forest acreage was now gross 211.5 and net 171.4 million acres. I wondered what a platted curve would look like, years and acreage to date, and as to probable projections from now on. Page 1 indicated thirty per cent of all present forest lands in the United States to be in public ownership. I wondered how much of that was state. Page 7 you were saying that of the 125-150 million acres now "badly depleted," some 50 million probably should be state and the rest federal. Page 28 you were saying that under the Fulmer Act many states, including Michigan, were "qualified" already, and that as soon as Congress came through with the money you were all set to get going with state forest expansions (to be mortgaged to the Secretary of Agriculture). That would be coming soon, I judged; and I wondered again at the seeming persistence of the Worst-First Theory in all this, and the implications.

Here in Michigan, for instance, your people had taken on quite joyfully much of the very leanest land in the region and were laboring therewith: with fire and blister-rust protections, surveys, plans, very large scale pine plantings and so on, —and on lands which mebby *never did*

have a decent stand of well-grown timber (Huron, Manistee, etc.) And it would be income and tobacco tax money out of Detroit and Grand Rapids, etc., no doubt, which was being so invested, and was that all right? It made me wonder quite a lot. *Was* it, properly speaking, "investment?" *Was* there, I wondered, a valid expectation of subsequent returns such as to justify such spendings on such lands? Would such national (or state) forest units, *ever* become even self supporting? One never found any discussion of such questions in the Foresters' Reports and I wondered why. Expenditures $108—net income $3.6. But that would not be just National Forest business and would include everything else: fire cooperations, investigations (field and laboratory), general overhead and so on.

What would a nothing-else-but national (or state) forest bookkeeping look like? If tried for, how *should* such books be set up? Be kept without direct or indirect faking? I didn't know—doubted that you did. But we might, assuredly, do much better (be more honest?) than we *have* been doing.

There are records, for instance, of the specific areas planted out each year, with maps, stock used, labor involved, etc., and there will have been periodic check-ups on the resulting plantations. Why not, then periodically, if not annually, enter up "current status" opposite the plantation "original costs" and with another entry show the "carrying costs" (as fire and blister rust protection, share of overhead, pruning or thinning operations, etc.)? If a valid investment (instead of rat-hole operation) we evidently must know, and show, what we are actually getting (or stand a fair chance to get) in returns on the money as spent: first costs, carrying charges to date, current status of and prospects for plantation.

"Status" might readily be indicated under such heads as "Good stand established and growth O. K.," "Stand only fair, condition good," "Stand or growth poor," "Failure" (drought, fire, bugs, ice-storm, rodents, etc.). But I'd never seen any such record or summary statement—federal or state—and I had to wonder why.

Even with such statements, of course, there would be no real book balance to be had because nobody would know what the ripe stands would finally be worth. And the report was saying that plantation pine would yield only poor lumber in eighty years—unless hand-pruned soon enough. Such pruning of dead limbs would assuredly cost plenty labor; and likely enough so as to equal the first costs of land and planting (to get inferior lumber in eighty years, even if the plantation had behaved itself nicely en route?). And I wouldn't know whether, by then, knotty or other lumber would be much wanted in the markets; and you wouldn't know either.

A lot of your Michigan plantations (and ours too, of course) have suffered very badly of late years from drought. Many would have been "filled in" or really replanted, I presumed, but here was the report (page 46) showing 223,000 acres of planting or sowing for the year, nothing as to such previous records, nothing as to status or prospects, and with your Michigan nurseries having an "authorized output" of thirty-two million seedlings a year, and your current Michigan plantings 78,000 acres; but no cost figures.

I decided that I didn't like this sort of bookkeeping; wondered whether you did. From there I got to wondering whether foresters (conservationists, in general?) *could* be decently "honest." The intangibles would be so all mixed up with the tangibles and standard (black and red) bookkeeping could deal with the tangibles only.

What it "costs" a fisherman or hunter to "go on a trip," for instance, (actual money, plus time, effort, etc.), will have almost no relation to the market value of

the meat which he brings home. He goes "for fun" and not just for meat. The fisherman or hunter will admit cheerfully that his trip cannot "pay out" in the tangibles, but will insist that it nevertheless has been "worthwhile." I wondered where and how much of the forester's proposals and intents were really based on some such consideration. *Could* "forests" perhaps prove well "worthwhile" even though they did not "pay?"

Such combinations were sometimes very real, I thought, as in the case of "raising a family," perhaps—but just how or where and when might anything like that apply to lands kept under sustained-yield management a la the forester's central formula? I wasn't at all sure; wondered whether you were. Over and over in the report you were using such phrases as "social welfare," "economic stability," "vital public interests," etc. Did you really "have something there," I wondered, or were you just fumbling at things hunched rather than "thought clean?" I could not be sure; doubted that you would be.

In any case there would, it seemed to me, be at least three complexes tangled up in all these "conservation" affairs: technical, economic, and social, and badly needing identification, segregation, discussion, clarification. Worst of all, I thought, they probably needed debunking treatments:—To be more than joshing but less than snarls or sneers perhaps.

On page 17, for instance, you were bragging very properly as to fire control accomplishments to date. *There*, it seemed to me, was a "sumpin" at which foresters properly could point with pride. But you were noting that control was now running into diminishing returns and you were promising new and more intensive (and expensive?) efforts "to counter-balance this influence." Here evidently we had another variable approaching its limit —and beyond some certain point it *wouldn't be worthwhile* to try to reduce forest fire losses. I wondered where that point would be found; doubted that you knew or would want to guess.

On page 32, under "Research" I found another "sumpin'" which kept me hung up for quite a spell of wondering: "prelim estimates indicate some 50 per cent more timber volume . . . in Michigan than previously supposed . . . most of it scattered . . . of minor species and economically unavailable . . . but with growth rates several times larger than previous estimates." Yes, I thought, that would be the "scrub" sprout-oak and the red-maple and white-birch, jack pine, popple, et al., come in and going to it as the fires have been kept down. Already real forests of it established on several million acres, and several times as much coming on fast; due to keep on coming fast and faster as the fires are kept down to low and lower brackets; and especially on the so-so lands such as make up the bulk of your and our local forest units.

Back in 1905 or so, as a student, I had helped put out our first pine plantations on such morainic and wash-plain sands, gravels, and light loams, and from the top of the big ridge north of Higgins Lake we could then watch a dog running a deer into the lake. The brush was so low and ragged that we almost entirely disregarded it as we planted the little pines.

In the absence of fire that clumpy "scrub" had come on so fast that by 1920 it was badly crowding much of the planted pine—very little of which would be able to "top out" so as to make good log trees (if, when, and as).

While this was happening your Lake States Forest Experiment Station was working on artificial drainage for spruce swamps, on the origins of birdseye maple and on tree genetics, et al. Meanwhile your local foresters have been busily planting more little pines in sands and gravels where the wild "scrub" already is established and coming fast, and your re-

port mentions the situation (for the first time?) in a short paragraph in fine print. And meanwhile very large areas of what was recently good deer and grouse country have "closed in" with this sort of second growth, so as to have become hardly worth hunting in.

It seems to figure out into a sort of proposition: If increasingly good fire control in thirty years has generated n-million acres of "economically unavailable" scrub forest which is progressively less and less productive in wildlife, what shall we have after thirty more years of increasingly good fire control? I couldn't find anything about that in the Report; or as to the costs of operating a Regional Forest Experiment Station; but this time I *didn't* wonder why.

On page 48 was an interesting table of estimated big game on the National Forests, Michigan being credited with 135,000 deer "as your share of our total deer populations," and on page 22 you were reporting that you now have "at least eighteen important winter-problem areas" within your boundaries; also that refuges, even though well located and successful, may presently become liabilities, and that as too-great populations (deer, elk, moose, et al) develop, "positive measures" may become urgent.

That, I thought, was very good dope indeed; but I wondered whether the same logic also would not apply to over-populations of trees and too much "economically unavailable" forest. You evidently could be quite calm about turning the rifles into surplus does; would you remain calm in the contemplation of fires turned loose to control surplus scrub or other forest . . . ? I hoped so, but on page 3 you were cracking down on "exponents of compound interest . . . who say we can have too much timber," so I couldn't feel sure.

And I couldn't feel sure, either, that an assumption that we *might* here and there have more forest than we would know what to do with (or too much farming, or too many potatoes, elk, hogs, oak or pine trees, etc.) would of necessity require approval of an "economy of scarcity."

Neither could I feel sure as to what presently might be coming out of the "activities" of the 1,500 regular officers and of the "83 specialists" now at work on your Wildlife Management affairs (page 22); plus the further activities in "Recreation" (page 23); plus Regulation G-20-a (wasn't it?) under which the Secretary of Agriculture will (try to?) take over what he wants to of fish, game and fur affairs inside the national forests.

Under the pressures of perennial deficits you might, I suspected, be tempted (if not forced?) to start collecting your own fishing and hunting license fees—thereby perhaps indefinitely cutting in on the funds now chiefly supporting state conservation activities. In that case, as you expanded we should shrink, and I thought some excellent wondering might be done in that connection.

In various places the report had noted such items as that tractor-truck logging practice had "revolutionized" many local combinations; that the markets for turpentine and charcoal were on the bum; that the big new-process pulp and paper plants had you worried lest they still further overtax the already failing supplies of southern pine and that lignin was now known to be crystalline and not amorphous. Looking back on 1938 from about 1950 or 75, I wondered whether that last (lignin) item might not appear as the only one of really large importance.

So many variables breaking in every little while—technical, economic, social; each with its own complex, and any item of any phase apt to unbalance the old equations no telling where or how much—as it seemed to me. But it evidently didn't seem that way to you, for in large type on page 2 was your Three-Point Program, and I read it thus:

I—More and bigger National and State

Forests (state acreage increasingly under the control of the U. S. Forest Service).

II—More public cooperation with private parties (at least so as to keep on expanding the federal Experiment Stations, Demonstrations, Investigations, and such-like mixtures of Service and Kid-in-Sand-pile).

III—Regulation (margin of U. S. Forest Service sovereignty over lumber industry, et al, and Front White Horse and Knight with Banner).

I presumably would be expected to take this program at full face value and to make comment accordingly. As I read along I kept wondering whether or how I could do that. Something about it kept teasing me but for quite a while I couldn't find out what; or a seemingly O.K. place to take hold; but finally I did. This, I decided, was a normal projection of the old Forest Service curve.

Quite so and of course! In early Pinchot time it had been the Timber Famine, and the "Standing Timber" reports of the Bureau of Corporations. . . . In Greeley time it had been the Capper Report, and the S. A. F. Committee Report on "Forest Devastation and a Plan to Meet it," and "Mine or Crop?" (And hadn't I personally ridden in those lists, lance-in-rest and spurs socked into the White Horse?). Then, in recent time had come the Copeland Report and the N.R.A. code. Now in modern time here was the Silcox Report and Three-Point Program.

Yes, I decided, this would be another point to spot in on the old curve; but how come, anyway? Hadn't somebody commented on curves like this and said they tended to repeat very dependably? Why sure! That would have been a Great Engineer, now titular, and he had said that bureau behaviors might always be expected to take the same patterns; that bureaus always would try to so orient themselves as to:

1. Become self-perpetuating.

2. Expand, multiply, and sub-divide their powers and duties.

3. Get themselves further and more generously implemented for the servicing of such powers and duties.

The Forest Service curve would plot out very nicely to that formula, I judged, but would the curves of other old-line bureaus that I knew? I'd better try a few. The G.L.O.? Had it shown such a curve? Sure it had. Starting out with its assigned and accepted job, the disposal of the public domain to private parties, hadn't it held to its curve right through Ballinger and Teapot Dome? The traffic lights meanwhile had changed from green to red, but the G.L.O. had driven right on through, as per its bureau curve.

How about the Reclamation Service? Starting with its Water-the-Desert formula hadn't it held to its curve in spite of wholesale bankruptcies among its projects, tacking back to its course on any breeze?

Had the technologists of Agriculture noted it when their new and better ways began to back-fire into toxic surpluses? Oh yes, they had; but holding to their curve they called it "under-consumption" and denied that there could be any "overproduction"; and even while they were paying farmers to plow down crops they had held to their curve and its slogans with beautiful consistency.

The National Park Service? Starting off with its Precious Primitive, and still carrying its wreaths to that old altar, still it could ram in C.C.C. roads so as to let Ding's fat lady from Kansas see everything from a car window in half an hour.

And so on indefinitely, seemed like as if. Yes, it seemed to check. But check *to* what? What might be the basic formula to which all such Bureau curves conformed? Some sort of equation, perhaps to summarize the laws of bureaus and their Dominant Ideas, pure and potent, to which they always must reorient themselves, green or red, red or black.

There ought, I thought, to be some key word or phrase for this repeater curve affair, pure, dominant, persistently curving up to or toward what, I wondered? Why to The Mount, of course!

And how nicely that would work out, too! Moses, John the Baptist, Crusades, Inquisition, Joan of Arc, Bryan, Carrie Nation, Fr. Coughlin and right on through; all crying from the desert and eating locusts, and Harold-the-Ickes anyway full of bugs.

Always some wicked Pharaoh oppressing the people; always some prophet going up the Mount and there hearing the Voice, and collecting the Tablets presently to be translated (by him) into directions for getting to the promised land. C.C.C. manna might or might not fall en route or on schedule, of course, but the pattern would be the same. That would be the pattern of the Fernow-Pinchot-Roth-Greeley-Silcox curve no doubt, and the word for it would be "evangelical."

The timber famine, forest devastation, exploitation, idle stump lands, delinquent taxes, et al., would be as the wicked Pharaoh; the Capper and Copeland reports, et al., would be as the Tablets off the Mount—properly translated by duly designated prophets these would spell out Sustained Yield Management as the Through Route to the Promised Land of Economic Stability, Social Welfare, Long-run Public Interest, and so on. Of course! So now, again, the Chief of the U. S. Forest Service must take the rod in hand and strike the rock! Three-Point Program and Q.E.D.

I wondered, about there, whether the curve might not be traced still further. En route to the Promised Land somebody probably would be due to set up a high-priced calf, and let grow awhile, the calf probably would change into a Sacred Cow. Big old bureaus probably would accumulate whole herds of these, and little bureaus some; and thereafter more and more of the time and effort of the Faithful would be required for the tending thereof; and to the Faithful it would probably seem very wicked indeed for anybody to run out on the tending of the Sacred Cows.

Mr. Kipling's Evarra would be the type specimen of the Faithful, perhaps, and the slogan always would be: "Thus Gods are made and whoso makes 'em otherwise shall die."

Figuring about like that I finished reading and making notes on the report and judged that I was not yet in proper shape to comment on the sum of it or as to the implications of the Three-Point Program. Meanwhile I had read the comment of a front-man for the National Lumber Manufacturers Association. He was, I thought, rude and inaccurate when he said the report was "full of half-truths." What did he expect for $108,000,000 anyway?

Were I criticizing, instead of merely commenting, I might complain a little that your cooking is a bit too highly flavored with butter from the Sacred Cows, but at that I could be glad that there was so little grade bull in it. Finally, as I seemed to come to a focus, I found that while I could again cheerfully go along with you fighting big fires in unmapped mountain country, I was not now going along with you cheerfully (if at all) with your 3-PP, and I wondered could I tell you why; but thought anyway I must try—so:

> First, I'm not willing to leave it to your Faithful to fetch down all the bigod Tablets.
>
> Second, I doubt the dove found in a hawk's nest is entitled to full consideration.

Two years ago one of your men brought to my outfit a copy of your Omnibus Bill, requesting and expecting (evidently told to get) our "endorsement." At about that time a man from the National Park Service brought us a similar bill, requesting and expecting (evidently told to get) our

"endorsement." In various particulars the bills would have canceled each other. Under the circumstances these federal-bureau people came to us with a fountain pen in one hand and a pineapple in the other. Long since I had become used to experiencing the big-federal-brother-wipe-little-state-brother's-nose, but this sign-here-or-else behavior was something different and quite put my hackles up (to put it very mildly indeed).

Last summer, with our legislature in session, I saw a C.I.O. local blockade the streets, hang a loud speaker on a pillar of the front entrance to the state capitol, and members of the legislature forced to use the side and back doors to go to work; and with the uniformed police officers ordered out of sight by elected officials.

Last fall I had occasion to dissect the Mansfield and related bills and like the others I found them full of strange federal proliferations and too-clever subreptions which had evidently been prayerfully wrought therein by relatives of Evarra. These bills (and much else such) had come fresh out of the middle of as-is Washington, in labor; and your report and program now comes thence. So, to put it very mildly indeed, I shall not be going along while Evarra is on a jag. Having helped to write the "Forest Devastation and Plan to Meet It" Report, I now shall have no occasion to question the pure intents of the current White Horse riders, but I shall be constrained to wonder whether all of hell is yet well paved.

I consider it a very good report from the best big bureau I know. Visit in on us sometime if you would like to see how fast a little bureau can shift its stance, retool its shop, and put out new and better models when the old dope begins to go sour.

P. S. Lovejoy.

Dear Lovejoy:

It seems to me that—using my annual report as a vehicle, or springboard—the real objective of your letter of March 15 is to question the whole New Deal philosophy without offering constructive suggestions or an alternative program with respect either to it or in connection with forestry matters.

This is disappointing. It, and your method of approach, makes it rather difficult for me to know just what you really want from me. I know you don't expect any long range discussion about the New Deal philosophy in general, although it's a matter I'd really enjoy arguing with you some time when we can put our feet under the same table. However, and despite my disappointment, I am glad you finally decided to send your letter, and I'm going to discuss—from the forest angle—certain major points you raise, either directly or by implication.

Many references in your letter have to do with expenditures by the Forest Service—expenditures that totaled some 108 million dollars in 1937—and costs. I take it you know we have a cost accounting system, and that the statement of expenditures in my annual report is not, and was not intended to be, a cost accounting statement. Since, however, I "can't be sure" (to borrow your pet phrase) about this, I'll say a word or two on this matter.

It is rather evident, I think, that such expenditures as $53,910,602.23 for investments (of which 15 millions is for acquisition, by the way) should not be balanced against National Forest revenues for a single year. As you know, forest highways ($8,514,543.36) are built primarily as a part of public transportation systems, national as well as local; the Prairie States Project ($1,730,650.78) is distinct from National Forests and has in larger part been a relief project. The two research brackets, totaling $4,293,731.59, cover national research; include basic research in matters which the lumber indus-

try, the livestock industry, farmers, private owners of forest lands generally, and the consuming public are primarily interested. The $16,371,943.30 was disbursed in connection with C.C.C. camps on state and privately owned lands, including those in Michigan. It, again, was in large part relief—via constructive work rather than by way of a dole. The $2,328,-294.83 for "Protection and Reforestation" is for cooperative work with states and others: a subsidy to states and others, if you will, not a National Forest expenditure. The $3,351,095.03 "Miscellaneous" covers work the Forest Service undertook on behalf other bureaus and agencies. And $1,242,542.05—the difference between gross and net receipts—was returned to states, largely in lieu of taxes.

The statements of expenditures (and the one covering gross and net cash receipts from National Forests) in my current annual report makes these things so evident that I cannot take seriously your reference to keeping books "without direct or indirect faking." Nor, in case you're trying to, can I let you get away with the thought that the present method of recording all expenditures, and gross and net receipts from National Forests, is anything new. We've always been required to keep such statements. They are included as a part of the annual report in an honest and open attempt to indicate—irrespective of costs and irrespective of National Forests alone—what total expenditures and total (as well as net) National Forest receipts are. And while we're on the subject, let me say that I am sure you don't believe we should still run the Hell Gate East "from a single small room with a piano box in which to store the pack saddles, scale sticks, calipers"; that "Zon's branch" should still be confined to "the blind end of an old hall in the Atlantic building"; that National Forest receipts should necessarily balance such expenditures as those I have mentioned.

It would be highly desirable, of course, if the National Forest system could be managed on a "cash and carry" basis. Yet I think (but to use your own expression again, I "am not sure") you *know* forest management is often worthwhile even though it does not "pay"; that with respect to the National Forests as a whole, for example, the "self-supporting" argument should not necessarily apply; that with public services forests render in such matters as water for domestic use and for irrigation; with services rendered in connection with floods and erosion, wildlife, inspirational values, and recreation, there is justification for forest management that may be other than self-supporting when measured by a cash balance yardstick.

And with a forest account that's widely overdrawn; with the need to increase the nation's basic wealth; with an established policy of acquiring exploited forest lands and building them back up so they may again produce as they can and should; with more than 14½ million acres of such lands now in the National Forest system; with a relief problem that, no matter what one's social and economic philosophy may be, just can't be kissed aside; in view of all these things, I believe most people might agree that there may be good reason for the National Forest system to be "in the red" so far as current cash balance is concerned; that as a nation we are very definitely justified in acquiring forest lands and rebuilding and administering them at public expense (so they may continuously yield services and produce forest products), even though these processes involve using "income and tobacco tax money out of Detroit and Grand Rapids."

It occurs to me, too, that it may be better to do this—even though we apply the "worst-first" policy in acquisition—in such a way as to provide worthwhile constructive work that is non-competitive with industry, instead of ignoring our relief problem because it is unpleasant or hard

to handle, or instead of trying to relieve it on the dole basis. For financial reasons, practice of the "worst-first" theory with respect to acquisition of forest lands is now probably the only practicable thing, generally speaking. Remember, though, that everything is relative: that although we have been buying "cheap" cut-over lands, 24 per cent of all those purchased and contracted for now bears merchantable timber, 53 per cent bears young growth rapidly approaching merchantable sizes, and from present indications only about 13 per cent will require artificial reforestation. So "worst-first" is in itself relative: is not blindly applied. And we are deliberately stepping out and getting operable stuff as we can, though this is within imposed limits that are largely financial, of course.

Now about cost records. In addition to a financial statement, which is, of course, very much more complete than the one given in my annual report, and which carries figures for the Forest Service as a whole, for each Region, and for each operating unit, we have the following:

1. Cost records by projects, kept in the field, kept in detail, kept by fiscal years.

2. An investment statement composed of page after page after page of figures in such small type that it takes a magnifying glass to read them. This statement gives costs on a unit basis and by classes, for the Service as a whole, by individual regions, and by individual operating units, of all improvements. It's kept in detail, and by years.

3. An activity cost statement, for the Service as a whole, by Regions, and by individual operating units, for all the many activities such as timber sales, grazing, wildlife, recreation (on both a revenue and non-revenue producing basis), timber stand improvement, fire prevention, etc. This record includes depreciation. It, too, has innumerable pages in such fine type that a magnifying glass is necessary to read the figures.

Were you familiar with these records when you wondered "how should such books be set up? Be kept? . . . without direct or indirect faking." All these records are public. The last two are published, yearly, and are available so long as the supply lasts. Do you think they should be included in an annual report that's limited in size; one of which, by law, we can distribute not more than 2,500 copies? If you have suggestions I will be glad to get them. They should come in handy, for we are now revising and simplifying our cost accounting system.

I agree with you that, theoretically at least, there is some point beyond which it probably will not be worthwhile to reduce fire losses. But do you believe that—for Michigan, for the country as a whole, for all privately owned forest lands, or for the National Forest system as a whole—that point has yet been reached? You and I both know that it's the relatively few fires that get away—that grow from little ones to whopping big ones—that do most of the damage and *cost the most money.* I know, as I think you do, that management—by whatever the agency may be, including the Forest Service—on these fires is by no means what it should be: that grabbing more of these fires while they are small, and better management on those that do get large, offers one of the best opportunities to cut damages and costs. The process of "rechecking and replanning", mentioned in my report, will help accomplish this. It can be accomplished without very much added expense. The same with better "fire weather forecasts", and "fire control techniques", including, for example, the fire danger meter which, so far developed, has already proven its worth as a means of putting forest forces on their toes at critical times.

Training, also specifically mentioned on

page 17 of my report, will cost something, it is true. But there is real need, with most all forest fire protection and suppression organizations, for better thinking and better planning. And despite implications in your letter, I don't believe you really question the value of training (or of these other things) provided, of course, costs are kept within reasonable bounds. So, when you re-read that portion of the sentence on page 17 of my report quoted in your letter ("to balance this influence of lower diminishing returns"), may I ask you to note that it is followed, in the same sentence, by the phrase "new measures to *guard against surprise fires, and* . . . are being employed."

If, from the wildlife section of my report, any thoughtful person can conclude that I "evidently would be quite calm about turning the rifles into surplus does" except in a managed way, and for an obviously necessary purpose, there's something woefully lacking in the report. We've all had experiences both with overkilling—particularly of deer and elk—and with overpopulation; overkillings and overpopulations often made possible by state laws and regulations, by the way. "Positive measures" to secure "management and control" in relation to wildlife may be abhorrent to you, but I should think overkilling by man, and overpopulation (with its resultant effects on the herd) might be even more abhorrent.

What my report meant by "positive measures" and "management and control" was, of course, securing a constructive balance between available forage and the game populations dependent upon that forage. Apparently this point was not made clear, yet I can't believe, as I have said, that any thoughtful person could conclude that I advocate uncontrolled use of "rifles in surplus does" any more than I advocate indiscriminate use of fire to "control" what you call "surplus"—or any other—"scrub or forest growth."

We already have public ownership and management (federal, state, and community) of forest lands in this country. This policy is well established. The policy of public cooperation with private owners of forest lands is also well established. So—in matters of fire protection, for example—is the policy of public sovereignty over forest lands in private ownership—public regulation, if you will. The belief that forest lands, no matter who owns them, are in effect public utilities, is growing. So is the belief—within the lumber industry itself—that wider exercise of sovereignty will help protect progressive owners from unfair competition within industry itself.

If private ownership of forest lands recognizes and redeems its responsibilities—and I sincerely hope it will—public ownership and management of forest lands should be held within certain limits, of course. Even though an adequate quid pro quo is assured—even though sustained yield is assured in return for forest credits, for example—public cooperation with private owners of forest lands should also be held within certain limits. And no matter how badly exercise of additional sovereignty over private forest lands is needed, it, too, should be kept within certain limits.

That's why, instead of arguments that seem to me to be specious, I had hoped for constructive suggestions with respect to my proposed "three-point program"; with respect to wider application of public regulation, particularly. Since you didn't come through, however, I'm going to expand on what I believe are certain basic essentials of public regulation, with the hope that you will really analyze and comment on them.

There's no question in my mind but that public regulation is necessary, and is on its way. But I want it to come as a cooperative proposition, not as a bureaucratic pronunciamento. Adequate standards must be set up, but I want to see adequate and *local* representation and

participation by industry and public agencies; from the counties on up. There must be legislation, but I want legislation that will recognize cooperative methods of approving standards, and differences in basic forest conditions; that will provide for and safeguard the right to appeal and to court action in case of disagreement.

More education—by industry as well as by public agencies, and of industry as well as of public agencies and of the public—is necessary. I don't believe, with some people that there is need to put off the backlog of public regulation of cutting until the educational job is complete, but I do believe that legislation must provide for education, including actual and practical demonstrations on the ground. I also believe that with public regulation, *and as a part of it*, there should be more liberal public cooperation with private owners. It seems to me axiomatic that public regulation be as simple as possible, with such flexibility as will assure prompt and intelligent action under a highly decentralized system of administration. It also seems axiomatic that although the elective line should be strong and representative, it should be kept clear from the administrative one so that it cannot become a mere adjunct to bureaucracy.

One of the things that makes me sure public regulation is on the way, and that we can't (if we would) wait for prosperity throughout the industry—and the ultimate in education of industry and of the public—before it arrives, is the almost unanimous response, through editorials and letters, from the public. Another is the character of expressions from certain industry representatives. Like Bill Greeley, for example, who says "If regulation is to be part of our national forestry policy, let's take off our coats and get about it." Like I. N. Tate, of Weyerhaeuser. Admitting that private owners and operators have public responsibilities, he argues for "an intelligent program . . . that will fall short of regimentation and that will still apply the controls that we all recognize to be necessary."

Thanks, again, for your letter of the fourteenth. I appreciate it, for even though it didn't offer alternatives, it has been thought-provoking. And in that respect, at least, it served the purpose I'm sure you had in mind when you wrote it.

F. A. Silcox,
Chief, Forest Service.

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To the Editor,
Journal of Forestry:

It is rare that one finds in the Journal such a thought-provoking discussion as that dealing with wood consumption which appeared in the March issue.[1] To one trained in old-fashioned forestry and economics it opens up avenues of speculation that are new and startling.

It is quite evident that foresters, and even schools of forestry, have not kept up-to-date. We have been teaching that the practice of forestry has been held back in this country because virgin supplies of timber have made lumber so cheap that we could not afford to grow it. It seems the real situation is this: Lumber is so higher-priced that we do not use nearly enough of it, and the reason why it is so high-priced is that we have not applied forestry. To be sure, in European countries where forestry is general, lumber is high-priced than here. Those countries have not yet learned that lumber can be grown cheaply by the simple process of charging most of the cost to ply

[1]Duncan, Julian S. Institutional versus technological factors in wood consumption. Jour. For. 36:306-311. 1938.

wood, prospective food from sawdust, grazing, and other byproducts. As soon as this important fact is more widely understood, what a difference it will make in the price of lumber and the extent of its use!

Not only foresters, but also economists, it seems, are hopelessly outmoded. Economists have thought that to have goods of any kind it is first necessary to produce them. That idea, too, we should dismiss. It is only necessary to know that modern technology makes possible the production of goods, in which case we should simply assume that institutions can be invented to assure their manufacture and distribution. If we were only more free with our assumptions, how much pleasanter this world would be. The author of this article gives us just a few glorious glimpses of the results, such as summer homes in the country for all who are obliged to hibernate in urban multi-family houses.

I must confess encountering some difficulty in convincing other foresters of the advantages of this new approach to forestry problems, perhaps because of their failure to understand the significance of a socially desirable degree of demographic diffusion. One such forester remarked that when we have those summer homes for flat dwellers, robins will wear overalls. I fear he meant to be facetious, but his very skepticism illustrates better than he knew the boundless possibilities of this new plane of thought. After all, why not overalls for robins? Personally, I should not begrudge robins protective attire for the somewhat messy job of pulling worms out of wet lawns, any more than I would begrudge the dusty furnace man a summer home in the country. Perhaps it would be going too far to say that overalls for robins are *now* a basic need, but there is no reason why they should not *soon* become one, since more important requirements can be so easily supplied by public subsidies in the coming democratic welfare economy. It is hardly necessary to point out the numerous benefits flowing from overalls for robins—employment for textile workers, new markets to restore idle cotton acreage to production, fresh artistry in the inexpensive but beautiful designs created for these garments, reduction in socio-monetary cost of cotton cloth for human consumption because of the new byproduct.

But enough—I would not attempt to exhaust the inexhaustible. It is sufficient to emphasize that this article demonstrates that all things are possible to an industrial society when it succeeds in applying engineering principles to economic processes and in controlling its social evolution. We foresters should cast aside apathy, forget hampering hypotheses, and on the basis of more promising postulates take our rightful place of leadership in the neotechnic civilization as it occupies its logical habitat in the upland areas.

R. C. Hall,
U. S. Forest Service.

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